LG Display

LC420WUE

Product Specification

SPECIFICATION
FOR
APPROVAL

(   ) **Preliminary Specification**

(●) **Final Specification**

Title	42.0" WUXGA TFT LCD

BUYER	General
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LC420WUE
SUFFIX	SBC1(RoHs Verified)

*When you obtain standard approval,
please use the above model name without suffix

APPROVED BY	SIGNATURE DATE
/	
/	
/	

Please return 1 copy for your confirmation with
your signature and comments.

APPROVED BY	SIGNATURE DATE
J.T. Kim /Team Leader	
REVIEWED BY	
S.J. Lee / Project Leader	
PREPARED BY	
J.S. Lee / Engineer	2009.01.09

TV Product Development Dept.
LG Display Co., Ltd.

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RECORD OF REVISIONS

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1. General Description

The LC420WUE is a Color Active Matrix Liquid Crystal Display with an integral External Electrode Fluorescent Lamp (EEFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive display type which is operating in the normally black mode. It has a 42.02 inch diagonally measured active display area with WUXGA resolution (1080 vertical by 1920 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arrayed in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 10-bit gray scale signal for each dot. Therefore, it can present a palette of more than 1.06B colors.

It has been designed to apply the 10-bit 2-port LVDS interface.

It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.
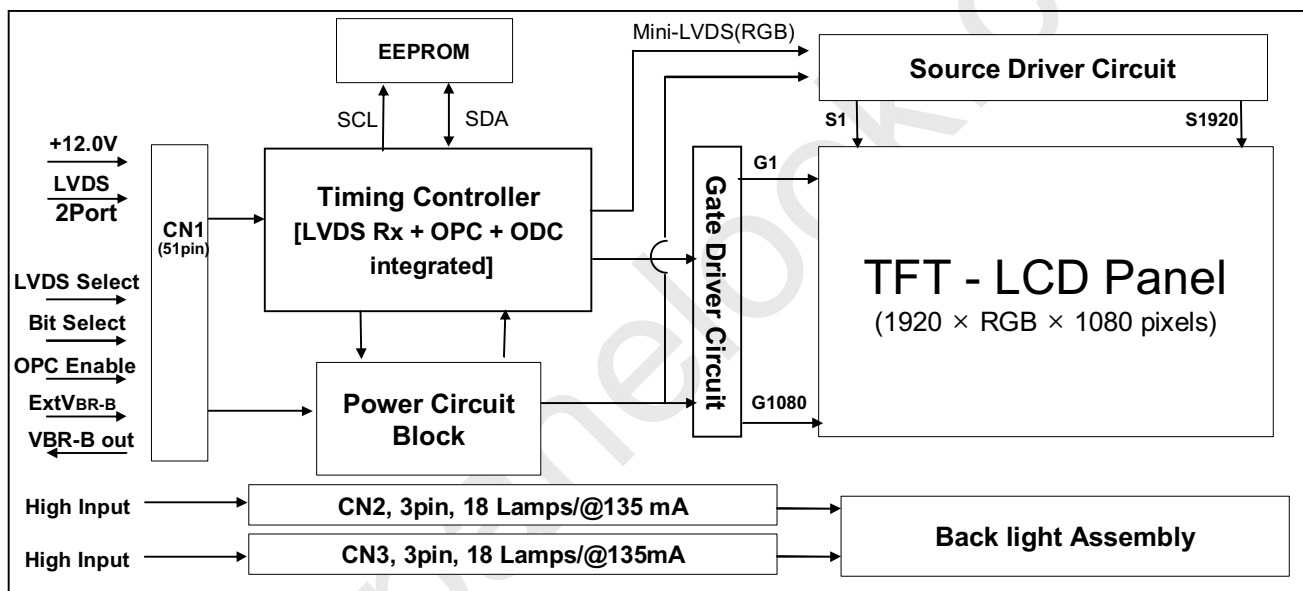
General Features

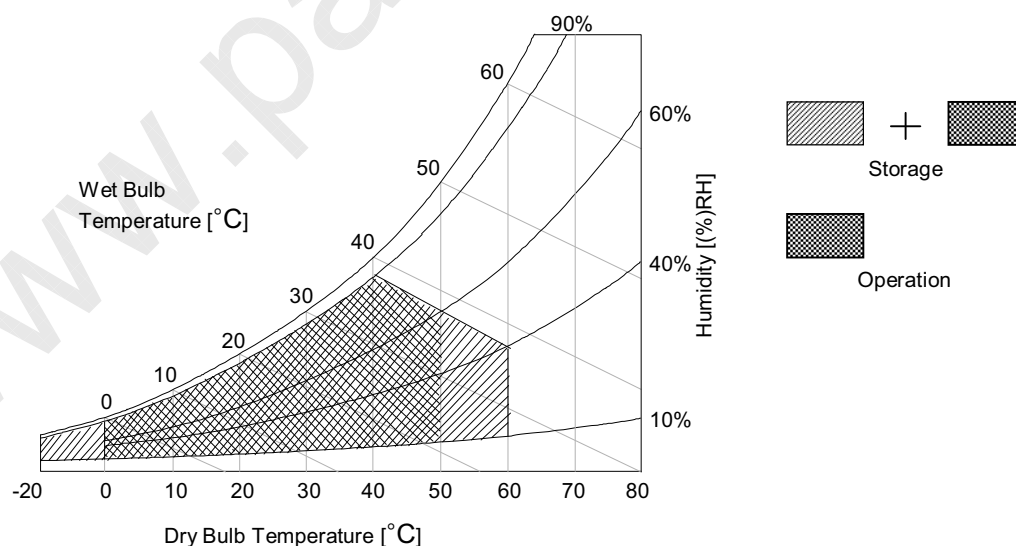|	
Active Screen Size	42.02 inches(1067.31mm) diagonal
Outline Dimension	983.0(H) x 576.0 (V) x 46.0 mm(D) (Typ.)
Pixel Pitch	0.4845 mm x 0.4845 mm
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	10-bit(D), 1.06B colors
Luminance, White	500 cd/m^2 (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178 (Min.), U/D 178 (Min.))
Power Consumption	Total (166.8) W (Typ.) (Logic=6.8 W, Back Light=160W @ with Inverter)
Weight	11.0 Kg (Typ.)
Display Mode	Transmissive mode, Normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer (Haze 10%)

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2. Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or damage to the LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Value		Unit	Remark
			Min	Max		
Power Input Voltage	LCD circuit	V$_{LCD}$	-0.3	+14.0	V [DC]	at 25 ± 2 °C
B/L Input voltage	Operating Voltage (one side)	V$_{OP}$	700	1100	V[RMS]	at 25 ± 2 °C
Operating Temperature		T$_{OP}$	0	+50	°C	Note 1
Storage Temperature		T$_{ST}$	-20	+60	°C	
Operating Ambient Humidity		H$_{OP}$	10	90	%RH	
Storage Humidity		H$_{ST}$	10	90	%RH	

Notes : 1. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be Max 39 °C and no condensation of water.
2. Gravity mura can be guaranteed below 40℃ condition.

3. Electrical Specifications
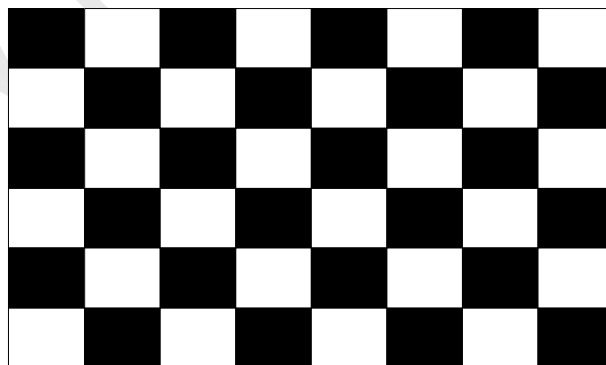
3-1. Electrical Characteristics

It requires two power inputs. One is employed to power for the LCD circuit. The other Is used for the EEFL backlight circuit.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V_{LCD}	10.8	12.0	13.2	V_{DC}	
Power Input Current	I_{LCD}	-	562	731	mA	1
		-	795	1034	mA	2
Power Consumption	P_{LCD}	-	6.75	8.78	Watt	1
Rush current	I_{RUSH}	-	-	3.0	A	3

Notes : 1. The specified current and power consumption are under the V_{LCD}=12.0V, $25 \pm 2°C$, f_V=60Hz condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).

White :1023Gray
Black : 0Gray

Mosaic Pattern(8 x 6)

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Table 3. ELECTRICAL CHARACTERISTICS for IPB& Lamp (Continue)

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Backlight Assembly :							
Operating Voltage (one side,fBL=45KHz, I_{BL}= 135mArms))		V_{BL}	800	950	1100	V_{RMS}	1, 2
Operating Current (one side)		I_{BL}	126	135	144	mA_{RMS}	1
Established Starting Voltage (one side)	0℃	V_S	-	-	1225	V_{RMS}	1, 3
	25℃		-	-	1020		
Operating Frequency		f_{BL}	43	45	47	kHz	4
Striking Time		S TIME	-	-	1.5	sec	3
Power Consumption		P_{BL}		160		Watt	6
Burst Dimming Duty		PWM duty	20		100	%	9
Burst Dimming Frequency		1/T	98	-	182	Hz	9

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Lamp : APPENDIX							
Lamp Voltage (one side)		V_{LAMP}	820	1050	1090	V_{RMS}	2
Lamp Current (one side)		I_{LAMP}	3	7.5	8	mA_{RMS}	
Discharge Stabilization Time		T_S	-	-	3	Min	5
Lamp Frequency		f LAMP	40	45	80	KHz	
Lamp Temperature		T_{LAMP}			130	°C	
Established Starting Voltage (one side)	0℃	V_S			1225	V_{RMS}	3
	25℃	V_S			1020		
Life Time			50,000			Hrs	7

Notes : The design of the inverter must have specifications for the lamp in LCD Assembly.

　　　The electrical characteristics of inverter are based on High-High Driving type.

　　　The performance of the lamps in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter. So, all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter (no lighting, flicker, etc) has never been occurred. When you confirm it, the LCD– Assembly should be operated in the same condition as installed in your instrument.

※ Do not attach a conductive tape to lamp connecting wire.

　　If you attach conductive tape to the lamp wire, not only luminance level can be lower than typical one but also inverter operate abnormally on account of leakage current which is generated between lamp wire and conductive tape.

1. Specified values are defined for a Backlight Assembly.(IBL : 18 lamp, 7.5mA/Lamp)

2. Operating voltage is measured at 25±2°C(after 2hr.aging). The variance range for operating voltage is ±10%.

3. The established starting voltage [Vs] should be applied to the lamps for more than Striking time (S TIME) for start-up. Inverter open voltage must be more than established starting voltage. Otherwise, the lamps may not be turned on. The used lamp current is typical value.

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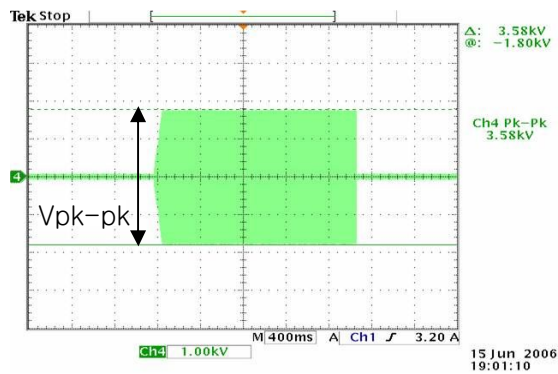
Vs = (Vpk-pk) / [2*root(2)]
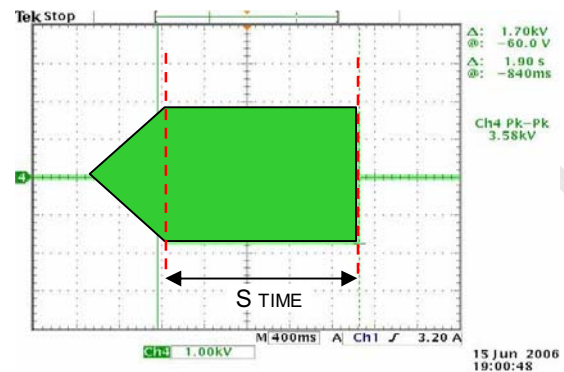
4. Lamp frequency may produce interference with horizontal synchronous frequency. As a result, the may cause beat on the display. Therefore, lamp frequency shall be away as much as possible from the horizontal synchronous frequency and its harmonics range in order to prevent interference.
There is no reliability problem of lamp, if use out of range of operation frequency (43kHz~55kHz) on CAS

5. The brightness of the lamp after lighted for 5minutes is defined as 100%.
T_S is the time required for the brightness of the center of the lamp to be not less than 95% at typical current.
The screen of LCD module may be partially dark by the time the brightness of lamp is stable after turn on.

6. Maximum level of power consumption is measured at initial turn on.
Typical level of power consumption is measured after 2hrs aging at $25 \pm 2°C$.

7. The life time is determined as the time at which brightness of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at $25 \pm 2°C$, based on duty 100%.

8. The output of the inverter must have symmetrical(negative and positive) voltage and current waveform (Unsymmetrical ratio is less than 10%). Please do not use the inverter which has not only unsymmetrical voltage and current but also spike wave.
Requirements for a system inverter design, which is intended to achieve better display performance, power efficiency and more reliable lamp characteristics.
It can help increase the lamp lifetime and reduce leakage current.
a. The asymmetry rate of the inverter waveform should be less than 10%.
b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$.
* Inverter output waveform had better be more similar to ideal sine wave.
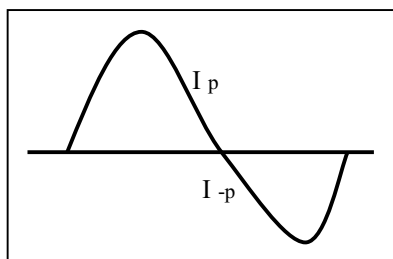
* Asymmetry rate:

$| I_p - I_{-p} | / I_{op}$ x 100%

* Distortion rate

I_p (or I_{-p}) / I_{op}

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9. The reference method of burst dimming duty ratio.
   It is recommended to use synchronous V-sync frequency to prevent waterfall
   (Vsync x 2 =Burst Frequency)
   Though PWM frequency is over 182Hz (max252Hz), function of backlight is not affected.
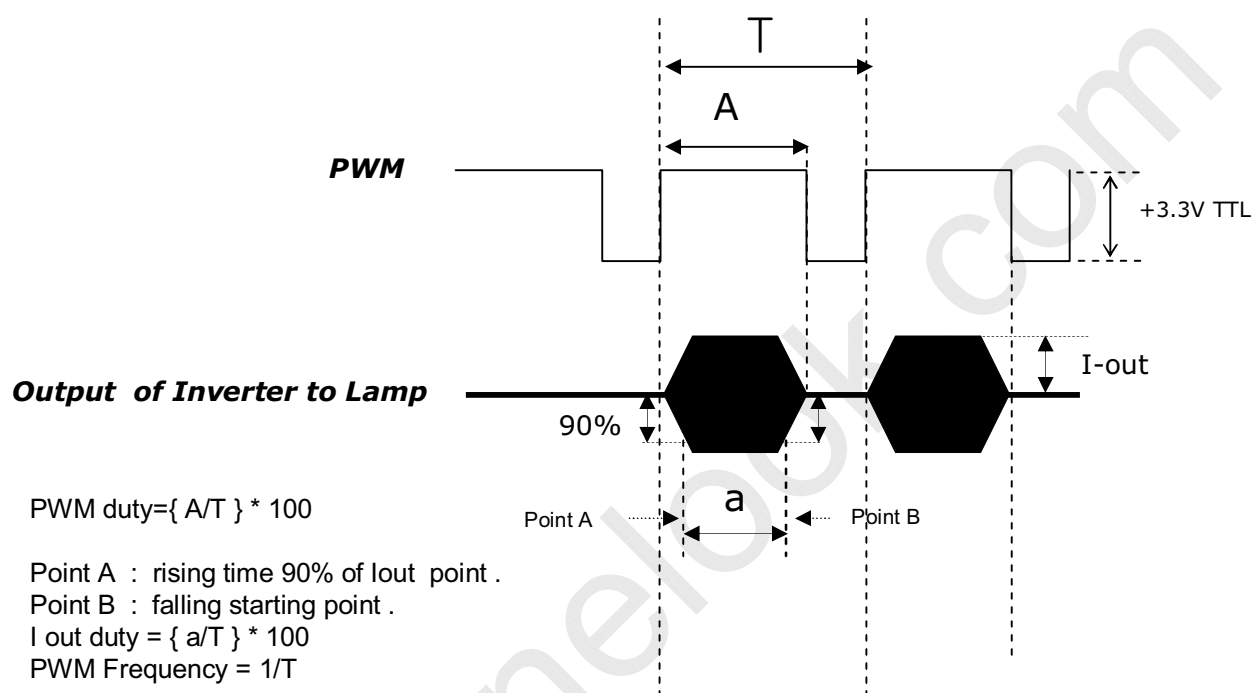
PWM

+3.3V TTL

Output of Inverter to Lamp

I-out

90%

PWM duty={ A/T } * 100

Point A   a   Point B

Point A : rising time 90% of Iout point .
Point B : falling starting point .
I out duty = { a/T } * 100
PWM Frequency = 1/T

※ We recommend not to be much different between PWM duty and Iout duty .
※ Dimming current output rising and falling time may produce humming and inverter trans' sound noise.
※ Burst dimming duty should be 100% for more than 1second after turn on.
※ Equipment
   Oscilloscope :TDS3054B(Tektronix)
   Current Probe : P6022 AC (Tektronix)
   High Voltage Probe: P5100(Tektronix)

10. The Cable between the backlight connector and its inverter power supply should be connected directly
    with a minimized length. The longer cable between the backlight and the inverter may cause the lower
    luminance of lamp and may require more higher starting voltage (Vs).

11. The operating current must be measured as near as backlight assembly input.

12. The operating current unbalance between left and right must be under 10% of Typical current
    │Left(Master) current – Right(Slave) Current│ 〈 10% of typical current

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3-2. Interface Connections

This LCD module employs two kinds of interface connection, a 51-pin connector is used for the module electronics and two 3-pin Balance PCB connectors are used for the integral backlight system.

3-2-1. LCD Module

- LCD Connector(CN1): FI-R51S-HF(manufactured by JAE) or KN25-51P-0.5SH(manufactured by Hirose)
- Mating Connector : FI-R51HL(JAE) or compatible

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	GND	Ground	27	Bit Select	'H' or NC= 10bit(D) , 'L' = 8bit
2	NC	No Connection	28	R2AN	SECOND LVDS Receiver Signal (A-)
3	NC	No Connection	29	R2AP	SECOND LVDS Receiver Signal (A+)
4	NC	No Connection	30	R2BN	SECOND LVDS Receiver Signal (B-)
5	NC	No Connection	31	R2BP	SECOND LVDS Receiver Signal (B+)
6	NC	No Connection	32	R2CN	SECOND LVDS Receiver Signal (C-)
7	LVDS Select	'H' =JEIDA , 'L' or NC = VESA	33	R2CP	SECOND LVDS Receiver Signal (C+)
8	NC	No Connection	34	GND	Ground
9	NC	No Connection	35	R2CLKN	SECOND LVDS Receiver Clock Signal(-)
10	NC	No Connection	36	R2CLKP	SECOND LVDS Receiver Clock Signal(+)
11	GND	Ground	37	GND	Ground
12	R1AN	FIRST LVDS Receiver Signal (A-)	38	R2DN	SECOND LVDS Receiver Signal (D-)
13	R1AP	FIRST LVDS Receiver Signal (A+)	39	R2DP	SECOND LVDS Receiver Signal (D+)
14	R1BN	FIRST LVDS Receiver Signal (B-)	40	R2EN	SECOND LVDS Receiver Signal (E-)
15	R1BP	FIRST LVDS Receiver Signal (B+)	41	R2EP	SECOND LVDS Receiver Signal (E+)
16	R1CN	FIRST LVDS Receiver Signal (C-)	42	Reserved	No connection or GND
17	R1CP	FIRST LVDS Receiver Signal (C+)	43	Reserved	No connection or GND
18	GND	Ground	44	GND	Ground
19	R1CLKN	FIRST LVDS Receiver Clock Signal(-)	45	GND	Ground
20	R1CLKP	FIRST LVDS Receiver Clock Signal(+)	46	GND	Ground
21	GND	Ground	47	NC	No connection
22	R1DN	FIRST LVDS Receiver Signal (D-)	48	VLCD	Power Supply +12.0V
23	R1DP	FIRST LVDS Receiver Signal (D+)	49	VLCD	Power Supply +12.0V
24	R1EN	FIRST LVDS Receiver Signal (E-)	50	VLCD	Power Supply +12.0V
25	R1EP	FIRST LVDS Receiver Signal (E+)	51	VLCD	Power Supply +12.0V
26	Reserved	No connection or GND	-	-	-

Notes : 1. All GND(ground) pins should be connected together to the LCD module's metal frame.
2. All V_{LCD} (power input) pins should be connected together.
3. All Input levels of LVDS signals are based on the EIA 644 Standard.
4. Specific pins(pin No. #2~#6) are used for internal data process of the LCD module.
   If not used, these pins are no connection.
5. LVDS pin (pin No. #24,25,40,41) are used for 10Bit(D) of the LCD module.
   If used for 8Bit(R), these pins are no connection.
6. Specific pin No. #44 is used for "No signal detection" of system signal interface.
   It should be GND for NSB(No Signal Black) during the system interface signal is not.
   If this pin is "H", LCD Module displays AGP(Auto Generation Pattern).

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3-2-2. Backlight Module

[Master]   **[Slave]**

　1) Balance Connector   　1) Balance Connector

　　: 65002WS-03 (manufactured by YEONHO)or equivalent   : 65002WS-03 (manufactured by YEONHO)or equivalent

　2) Mating Connector   　2) Mating Connector

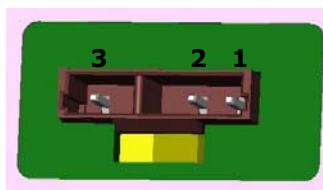　　: 65002HS-03 (manufactured by YEONHO) or equivalent.   : 65002HS-03 (manufactured by YEONHO) or equivalent.

Table 5. BACKLIGHT CONNECTOR PIN CONFIGURATION(CN2,CN3)

No	Symbol	Master	Slave	Note
1	H_Input	High_Input	High_Input	
2	H_Input	High_Input	High_Input	
3	FB	NC	NC	

◆ Rear view of LCM
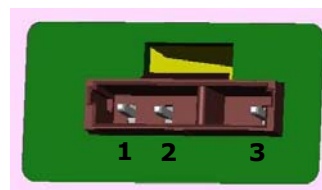
Master   Slave

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3-3. Signal Timing Specifications

Table 6 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timing should be satisfied with the following specification for normal operation.

Table 6. TIMING TABLE for NTSC (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	tHV	-	960	-	tclk	
	Blank	tHB	100	140	240	tclk	
	Total	tHP	1060	1100	1200	tclk	2200/2
Vertical	Display Period	tVV	-	1080	-	Lines	
	Blank	tVB	11	45	69	Lines	
	Total	tVP	1091	1125	1149	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	fCLK	70	74.25	77	MHz	148.5/2
	Horizontal	fH	65	67.5	70	KHz	
	Vertical	fv	57	60	63	Hz	

Table 7 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timing should be satisfied with the following specification for normal operation.

Table 7. TIMING TABLE for PAL (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	tHV	-	960	-	tclk	
	Blank	tHB	100	140	240	tclk	
	Total	tHP	1060	1100	1200	tclk	2200/2
Vertical	Display Period	tVV	-	1080	-	Lines	
	Blank	tVB	228	270	300	Lines	
	Total	tVP	1308	1350	1380	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	fCLK	70	74.25	77	MHz	148.5/2
	Horizontal	fH	65	67.5	70	KHz	
	Vertical	fv	47	50	53	Hz	

Note : The Input of HSYNC & VSYNC signal does not have an effect on normal operation(DE Only Mode).
 The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate.

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3-4. Signal Timing Waveforms

DE, Data

0.7VDD

0.3VDD

DCLK

t_{CLK}

0.5 VDD

Valid data

First data   Invalid data   Pixel 0,0   Pixel 2,0   Invalid data

Valid data

Second data   Invalid data   Pixel 1,0   Pixel 3,0   Invalid data

DE(Data Enable)
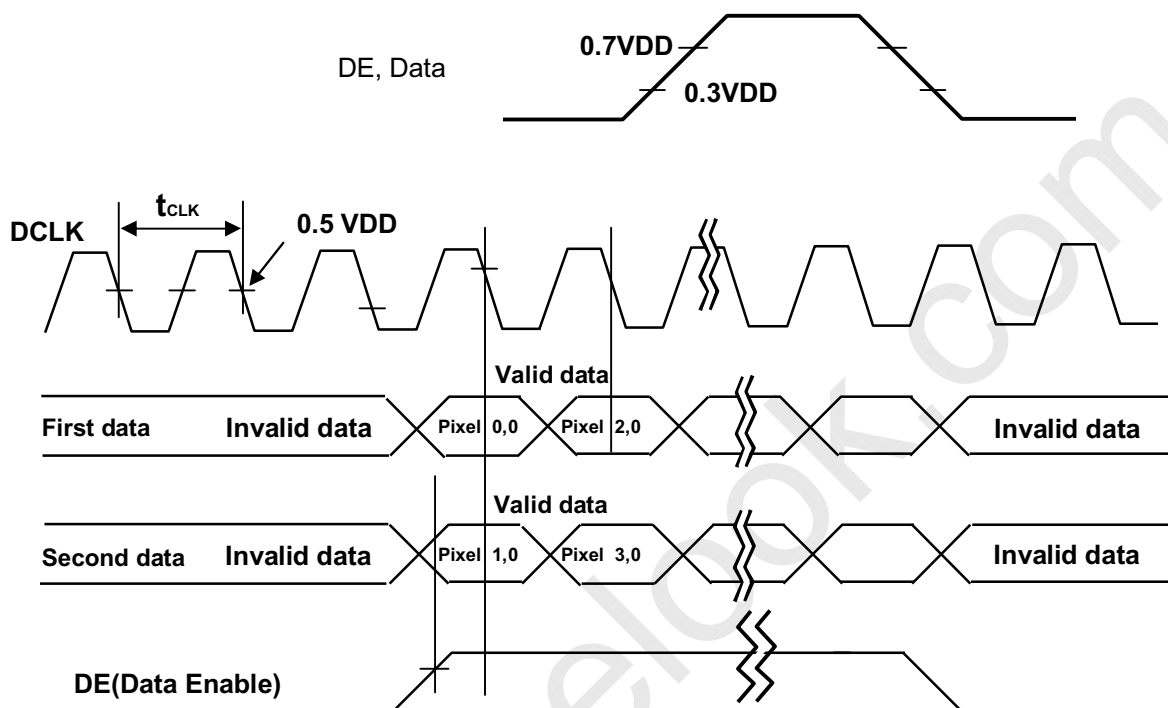
* Reference : Sync. Relation

* $t_{HB} = t_{HFP} + t_{WH} + t_{HBP}$

* $t_{VB} = t_{VFP} + t_{WV} + t_{VBP}$

t_{HP}

HSync

t_{WH}

t_{HBP} t_{HV} t_{HFP}

DE(Data Enable)

t_{VP}

t_{WV}

VSync

t_{VBP} t_{VV} t_{VFP}

DE(Data Enable)

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13 /42
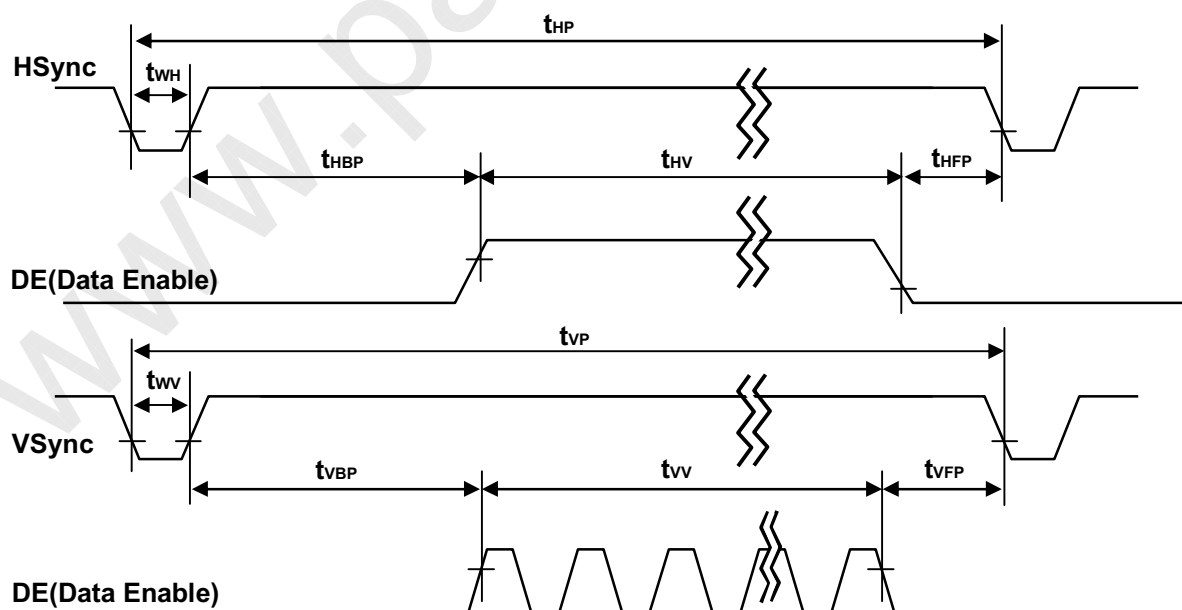
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3-5. Color Data Reference

The brightness of each primary color(red,green,blue) is based on the 10-bit gray scale data input for the color. The higher binary input, the brighter the color. Table 8 provides a reference for color versus data input.

Table 8. COLOR DATA REFERENCE

Color		Input Color Data		
		RED MSB LSB R9 R8 R7 R6 R5 R4 R3 R2 R1 R0	GREEN MSB LSB G9 G8 G7 G6 G5 G4 G3 G2 G1 G0	BLUE MSB LSB B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
Basic Color	Black	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
	Red (1023)	1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
	Green (1023)	0 0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0
	Blue (1023)	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 1
	Cyan	0 0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1
	Magenta	1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 1
	Yellow	1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0
	White	1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1
RED	RED (000)	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
	RED (001)	0 0 0 0 0 0 0 0 0 1	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
	...	...	...	...
	RED (1022)	1 1 1 1 1 1 1 1 1 0	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
	RED (1023)	1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
GREEN	GREEN (000)	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
	GREEN (001)	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 1	0 0 0 0 0 0 0 0 0 0
	...	...	...	...
	GREEN (1022)	0 0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 0	0 0 0 0 0 0 0 0 0 0
	GREEN (1023)	0 0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0
BLUE	BLUE (000)	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
	BLUE (001)	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 1
	...	...	...	...
	BLUE (1022)	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 0
	BLUE (1023)	0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 1

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3-6. Power Sequence
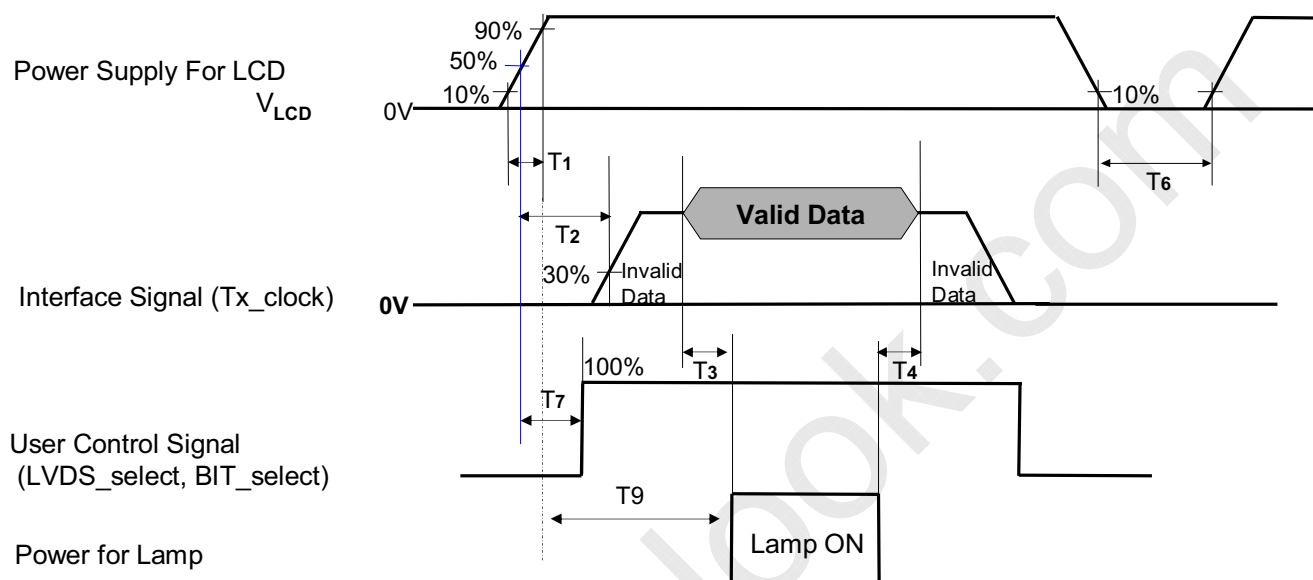
3-6-1. LCD Driving circuit

Table 9. POWER SEQUENCE

Parameter	Value			Unit	Notes
	Min	Typ	Max		
T1	0.5	-	20	ms	
T2	0	-	-	ms	4
T3	200	-	-	ms	3
T4	200	-	-	ms	3
T6	1.0	-	-	s	5
T7	0	-	T2	ms	4
T9	T2+T3	-	12	s	

Note :1. Please avoid floating state of interface signal at invalid period.

2. When the power supply for LCD (VLCD) is off, be sure to pull down the valid and invalid data to 0V.

3. The T3/T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.

4. If the on time of signals(Interface signal and user control signals) precedes the on time of Power(V_{LCD}), it will be happened abnormal display. When T7 is NC status, T7 doesn't need to be measured.

5. T6 should be measured after the Module has been fully discharged between power off and on period.

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4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at $25\pm2°C$. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.
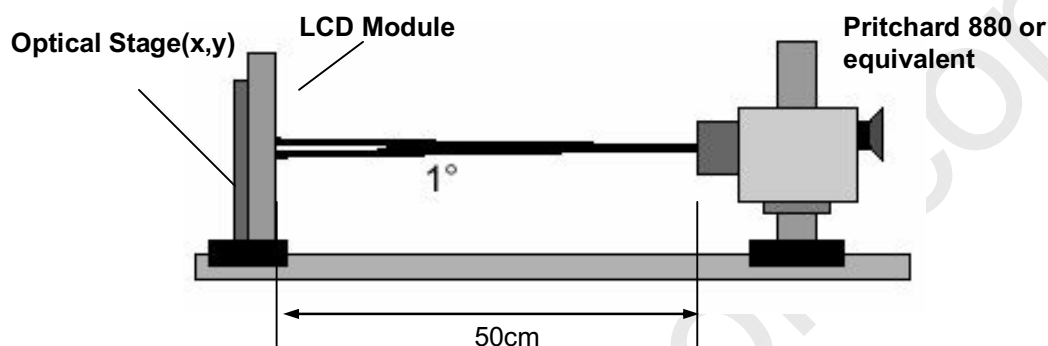FIG. 1 shows additional information concerning the measurement equipment and method.

FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 10. OPTICAL CHARACTERISTICS   Ta= $25\pm2°C$, V_{LCD}=12.0V, fv=60Hz, Dclk=74.25MHz, I_{BL}=135mArms

Parameter		Symbol		Value			Unit	Note
				Min	Typ	Max		
Contrast Ratio		CR		1000	1400	-		1
Surface Luminance, white		L_{WH}		400	500	-	cd/m^2	2
Luminance Variation		δ_{WHITE}	5P	-	-	1.3		3
Response Time	Gray-to-Gray	G to G			5	8	ms	4
	Uniformity	$\delta_{G\,TO\,G}$		-	-	1		5
Color Coordinates [CIE1931]	RED	Rx			0.638			
		Ry			0.334			
	GREEN	Gx			0.290			
		Gy		Typ -0.03	0.606	Typ +0.03		
	BLUE	Bx			0.144			
		By			0.064			
	WHITE	Wx			0.279			
		Wy			0.292			
Viewing Angle (CR>10)								
	x axis, right(ϕ=0°)	θr		89	-	-	degree	6
	x axis, left (ϕ=180°)	θl		89	-	-		
	y axis, up (ϕ=90°)	θu		89	-	-		
	y axis, down (ϕ=270°)	θd		89	-	-		
Gray Scale				-	-	-		7

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Product Specification

Notes :1. Contrast Ratio(CR) is defined mathematically as :

$$CR = \frac{\text{Surface Luminance at all white pixels}}{\text{Surface Luminance at all black pixels}}$$

It is measured at center 1-point.

2. Surface luminance is determined after the unit has been 'ON' and 1Hour after lighting the backlight in a dark environment at $25\pm2°C$. Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see the FIG. 2.

3. The variation in surface luminance , δ WHITE is defined as :

δ WHITE(5P) = Maximum(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}) / Minimum(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5})
Where L_{on1} to L_{on5} are the luminance with all pixels displaying white at 5 locations .
For more information, see the FIG. 2.

4. Response time is the time required for the display to transit from G(N) to G(M) (Rise Time, Tr_R) and from G(M) to G(N) (Decay Time, Tr_D). For additional information see the FIG. 3. (N<M)
※ G to G Spec stands for average value of all measured points.

5. Gray to Gray Response time uniformity is Reference data. Please see Appendix XI.

6. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.

7. Gray scale specification
Gamma Value is approximately 2.2. For more information, see the Table 11.

Table 11. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ.)
L0	0.07
L63	0.27
L127	1.04
L191	2.49
L255	4.68
L319	7.66
L383	11.5
L447	16.1
L511	21.6
L575	28.1
L639	35.4
L703	43.7
L767	53.0
L831	63.2
L895	74.5
L959	86.7
L1023	100

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Measuring point for surface luminance & measuring point for luminance variation.

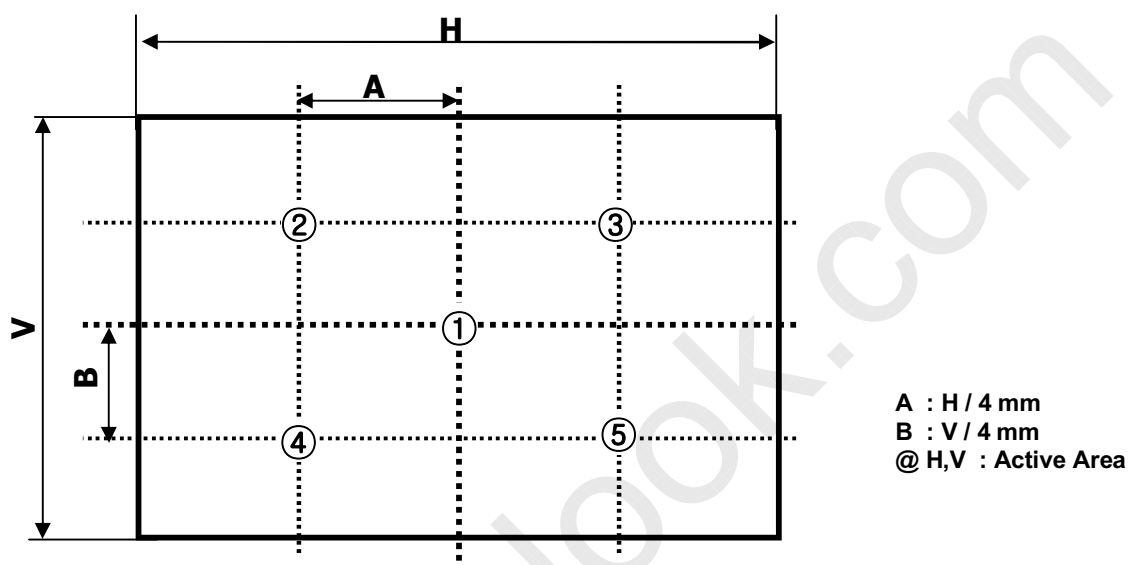A : H / 4 mm
B : V / 4 mm
@ H,V : Active Area

FIG. 2 5 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".
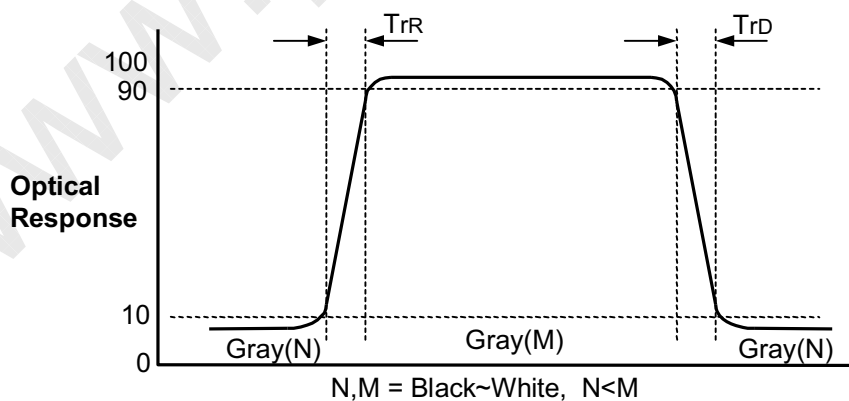

N,M = Black~White, N<M

FIG. 3 Response Time

LC420WUE

Product Specification

Dimension of viewing angle range
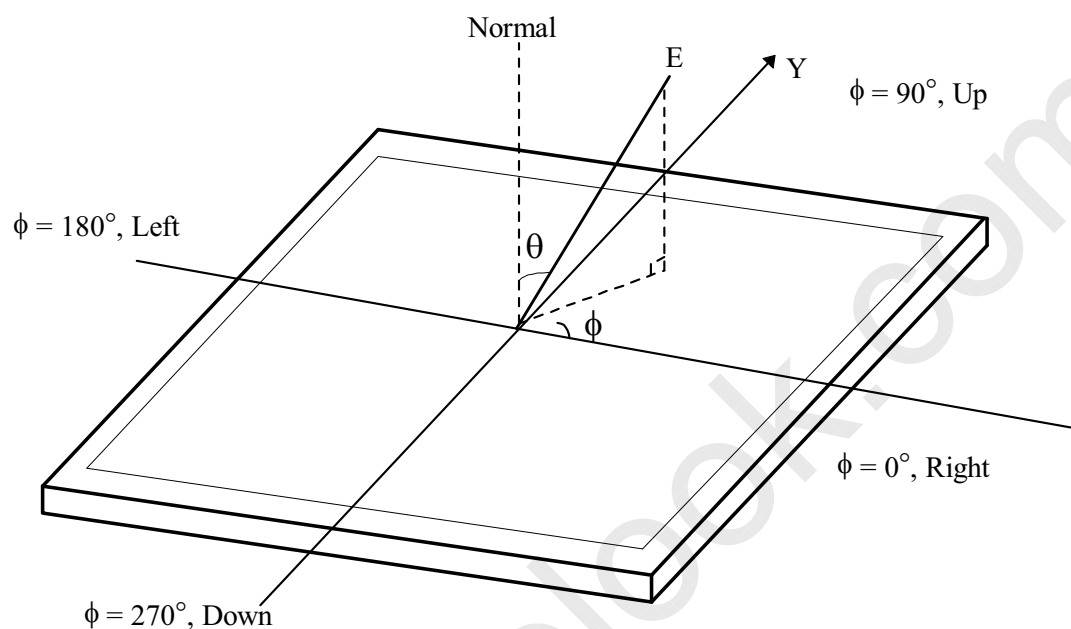
FIG. 4 Viewing Angle

Product Specification

5. Mechanical Characteristics

Table 12 provides general mechanical characteristics.

Table 12. MECHANICAL CHARACTERISTICS

Item	Value	
Outline Dimension	Horizontal	983.0 mm
	Vertical	576.0 mm
	Depth	46.0 mm
Bezel Area	Horizontal	939.0 mm
	Vertical	531.0 mm
Active Display Area	Horizontal	930.24 mm
	Vertical	523.26 mm
Weight	11.0 Kg (Typ.) , 12.0 Kg (Max.)	

Note : Please refer to a mechanical drawing in terms of tolerance at the next page.

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Product Specification

<FRONT VIEW>
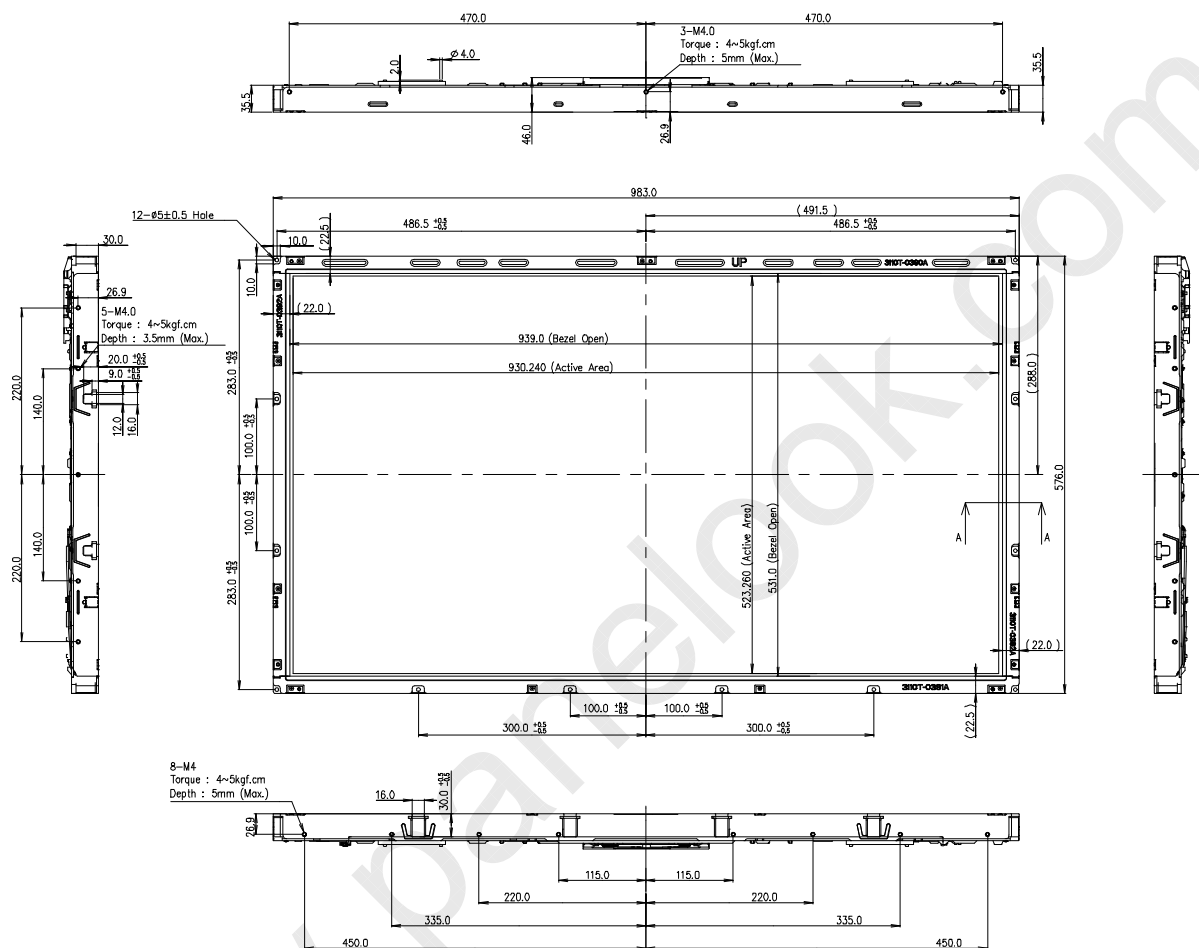
NOTES
1. Unspecified tolerances are to be ±1.0mm.
2. Tilt and partial disposition tolerance of display are
   are as following.
   (1) X-Direction : IA-BI ≤ 1.5mm
   (2) Y-Direction : IC-DI ≤ 1.5mm
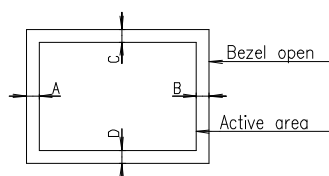
Bezel open

Active area

SECTION   A-A
SCALE   1/1

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Product Specification

<REAR VIEW>
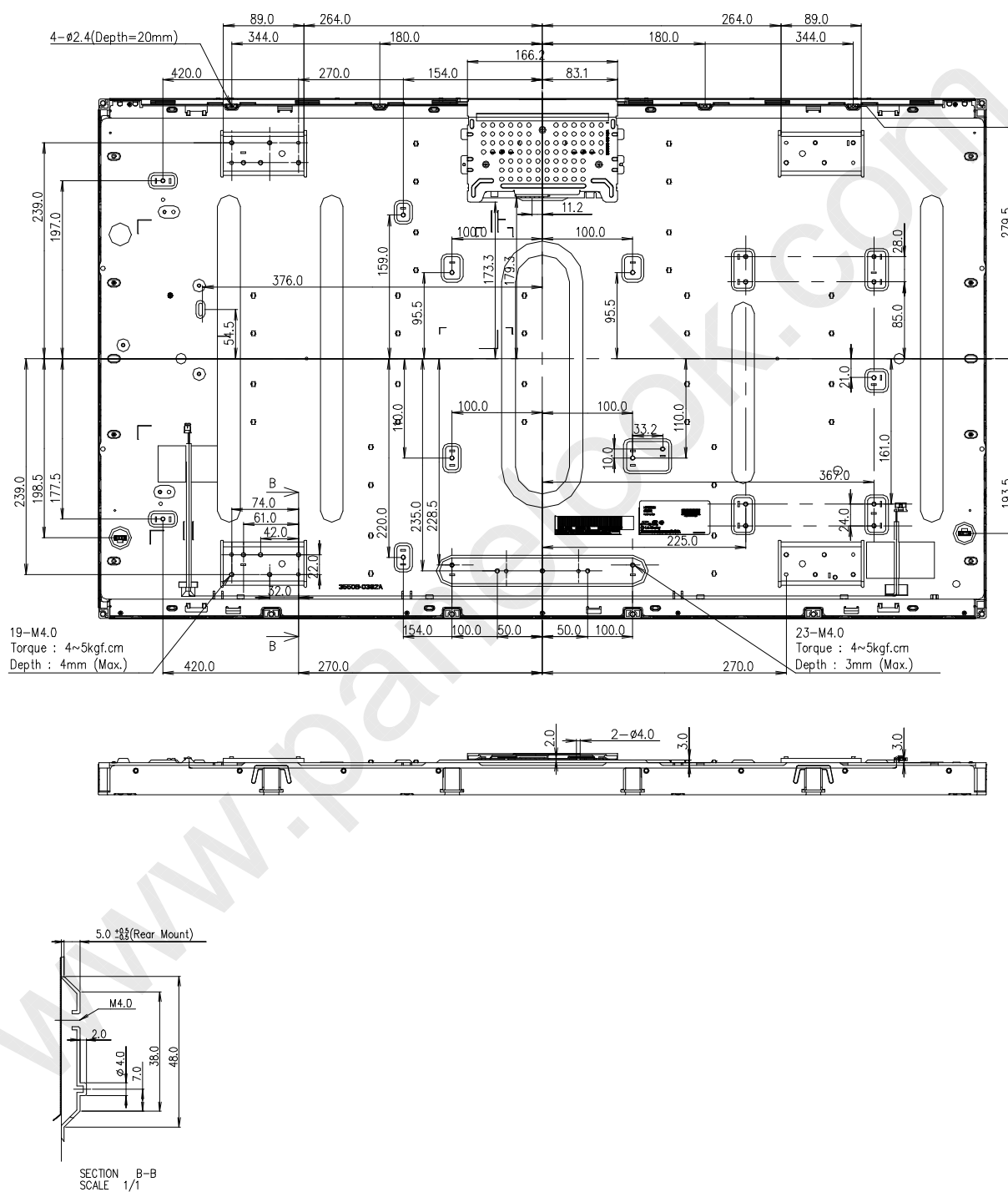
Product Specification

6. Reliability

Table 13. ENVIRONMENT TEST CONDITION

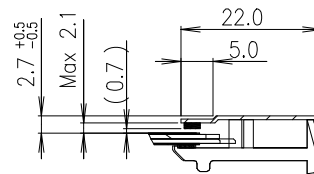| No.	Test Item	Condition
1	High temperature storage test	Ta= 60°C 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0Grms Bandwidth : 10-300Hz Duration : X,Y,Z Each direction per 10 min.
6	Shock test (non-operating)	Shock level : 50Grms Waveform : half sine wave, 11ms Direction : ±X, ±Y, ±Z One time each direction
7	Humidity condition Operation	Ta= 40 °C ,90%RH
8	Altitude operating storage / shipment	0 - 15,000 ft 0 - 40,000 ft

Note : Before and after Reliability test, LCM should be operated with normal function.

Product Specification

7. International Standards

7-1. Safety

a) UL 60065, 7th Edition, dated June 30, 2003, Underwriters Laboratories, Inc.,
   Standard for Audio, Video and Similar Electronic Apparatus.
b) CAN/CSA C22.2, No. 60065:03, Canadian Standards Association,
   Standard for Audio, Video and Similar Electronic Apparatus.
c) IEC60065:2001, 7th Edition CB-scheme and EN 60065:2002,
   Safety requirements for Audio, Video and Similar Electronic Apparatus..

7-2. EMC

a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and
   Electrical Equipment in the Range of 9kHZ to 40GHz. "American National Standards Institute(ANSI),
   1992
b) CISPR13 "Limits and Methods of Measurement of Radio interference characteristics of Sound
   and Television broadcast receivers and associated equipment"
   CISPR22 "Limits and Methods of Measurement of Radio interference characteristics of Information
   Technology Equipment" International Special Committee on Radio Interference.
c) EN55013 "Limits and Methods of Measurement of Radio interference characteristics of Sound and
   Television broadcast receivers and associated equipment"
   EN55022 "Limits and Methods of Measurement of Radio interference characteristics of Information
   Technology Equipment" European Committee for Electro Technical Standardization.(CENELEC),
   1988(Including A1:2000)

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Product Specification

8. Packing

8-1. Information of LCM Label

a) Lot Mark

| A | B | C | D | E | F | G | H | I | J | K | L | M |

A,B,C : SIZE(INCH)　　　　　　　　　　D : YEAR
E : MONTH　　　　　　　　　　　　　　F ~ M : SERIAL NO.

Note
1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	4	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial NO. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one Pallet : 13　pcs

b) Pallet Size : 1140 mm X 990 mm X 810 mm.

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Product Specification

9. Precautions

Please pay attention to the followings when you use this TFT LCD module.

9-1. Mounting Precautions

(1) You must mount a module using specified mounting holes (Details refer to the drawings).

(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.

(3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.

(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.

(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)

(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.   * There is no problem of Panel crack under 5kgf / φ10mm

(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits do not have sufficient strength.

9-2. Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=±200mV(Over and under shoot voltage)

(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)

(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer

(4) Be careful for condensation at sudden temperature change.Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.

(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

(7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.

(8) A screw which is fastened up the steels should be a machine screw.
(if not, it can causes conductive particles and deal LCM a fatal blow)

(9) Please do not set LCD on its edge.

(10) Partial darkness may happen during 3~5 minutes when LCM is operated initially in condition that luminance is under 40% at low temperature (under 5℃). This phenomenon which disappears naturally after 3~5 minutes is not a problem about reliability but LCD characteristic

Product Specification

9-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

9-6. Handling Precautions for Protection Film

(1) The protection film is attached to the bezel with a small masking tape.
When the protection film is peeled off, static electricity is generated between the film and polarizer.
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
(2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
(3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

LC420WUE

Product Specification

APPENDIX- I-1

■ **Required signal assignment for Flat Link (Thine : THC63LVD103) Transmitter (Pin7="L or NC")**
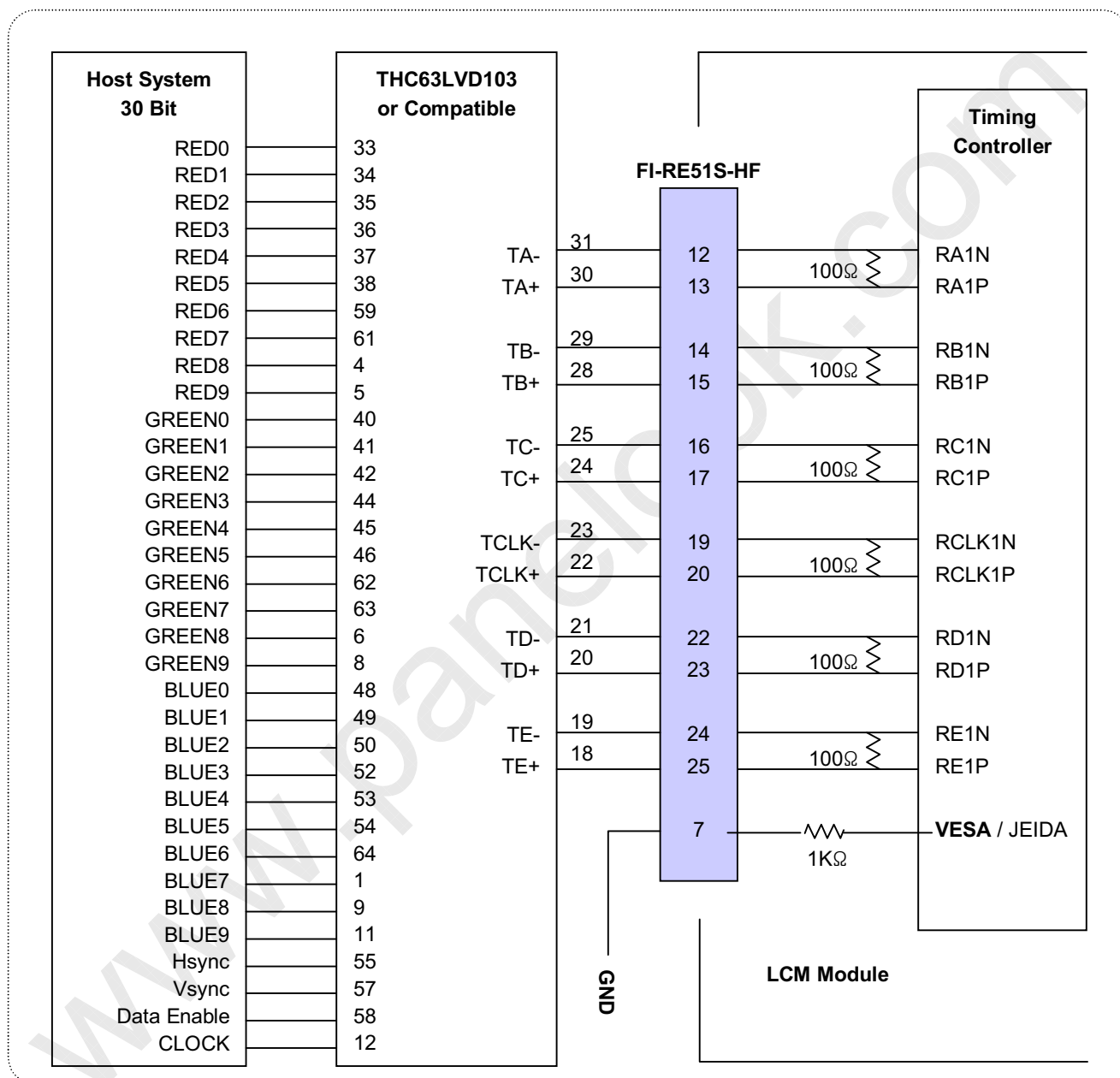
Host System 30 Bit	THC63LVD103 or Compatible
RED0	33
RED1	34
RED2	35
RED3	36
RED4	37
RED5	38
RED6	59
RED7	61
RED8	4
RED9	5
GREEN0	40
GREEN1	41
GREEN2	42
GREEN3	44
GREEN4	45
GREEN5	46
GREEN6	62
GREEN7	63
GREEN8	6
GREEN9	8
BLUE0	48
BLUE1	49
BLUE2	50
BLUE3	52
BLUE4	53
BLUE5	54
BLUE6	64
BLUE7	1
BLUE8	9
BLUE9	11
Hsync	55
Vsync	57
Data Enable	58
CLOCK	12

FI-RE51S-HF

TA-	31	12	RA1N
TA+	30	13	RA1P (100Ω)
TB-	29	14	RB1N
TB+	28	15	RB1P (100Ω)
TC-	25	16	RC1N
TC+	24	17	RC1P (100Ω)
TCLK-	23	19	RCLK1N
TCLK+	22	20	RCLK1P (100Ω)
TD-	21	22	RD1N
TD+	20	23	RD1P (100Ω)
TE-	19	24	RE1N
TE+	18	25	RE1P (100Ω)
		7	**VESA** / JEIDA (1KΩ)

GND

Timing Controller

LCM Module

Notes:
1. The LCD module uses a 100 Ohm(Ω) resistor between positive and negative lines of each receiver input.
2. Refer to LVDS transmitter data sheet for detail descriptions. (THC63LVD103 or Compatible)
3. '9' means MSB and '0' means LSB at R,G,B pixel data.

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Product Specification

APPENDIX- 1-2

■ **Required signal assignment for Flat Link (Thine : THC63LVD103) Transmitter (Pin7="H")**

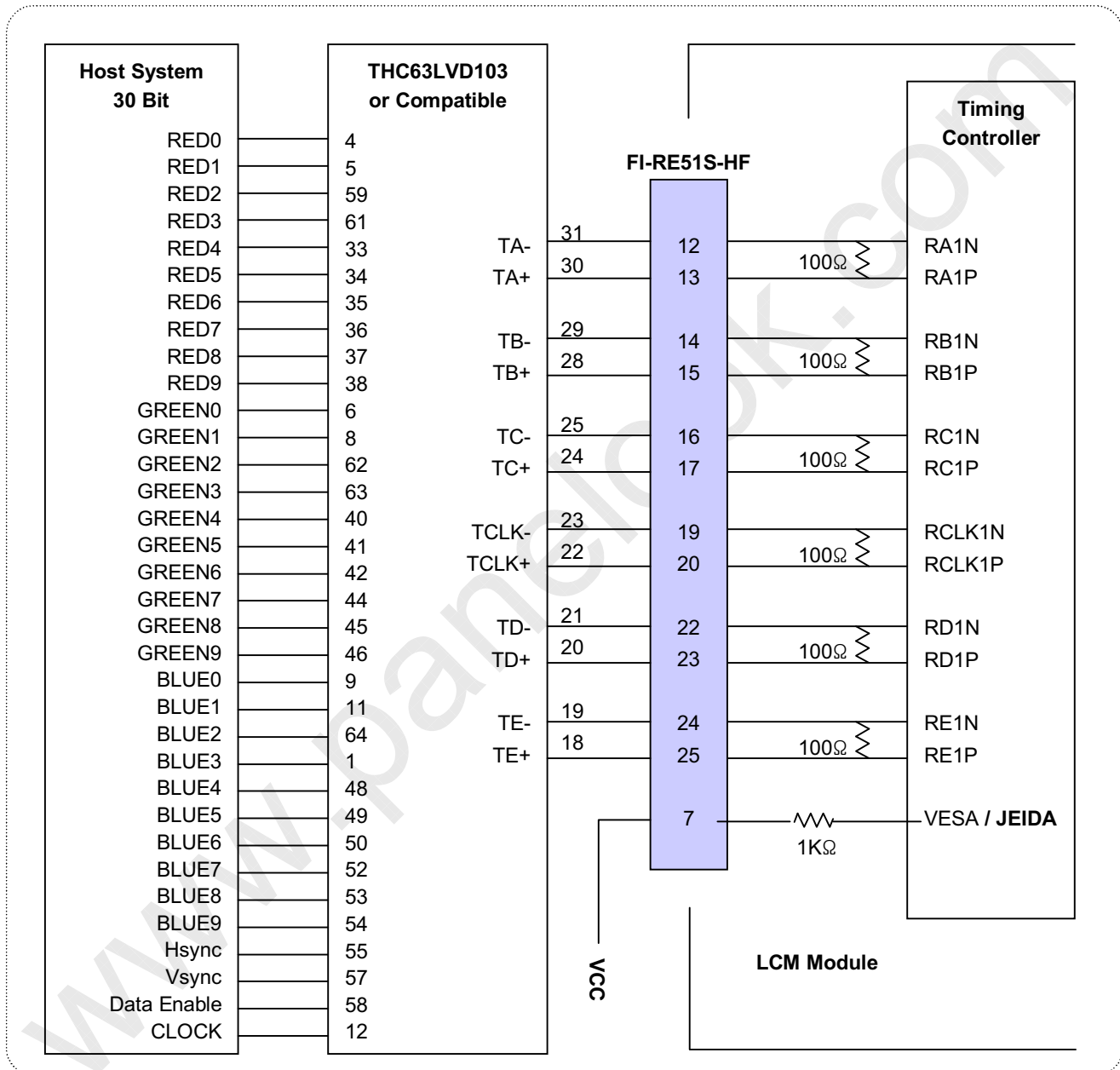| Host System 30 Bit	THC63LVD103 or Compatible		FI-RE51S-HF		Timing Controller
RED0	4				
RED1	5				
RED2	59				
RED3	61	TA-	31 → 12	100Ω	RA1N
RED4	33	TA+	30 → 13		RA1P
RED5	34				
RED6	35	TB-	29 → 14	100Ω	RB1N
RED7	36	TB+	28 → 15		RB1P
RED8	37				
RED9	38	TC-	25 → 16	100Ω	RC1N
GREEN0	6	TC+	24 → 17		RC1P
GREEN1	8				
GREEN2	62	TCLK-	23 → 19	100Ω	RCLK1N
GREEN3	63	TCLK+	22 → 20		RCLK1P
GREEN4	40				
GREEN5	41	TD-	21 → 22	100Ω	RD1N
GREEN6	42	TD+	20 → 23		RD1P
GREEN7	44				
GREEN8	45	TE-	19 → 24	100Ω	RE1N
GREEN9	46	TE+	18 → 25		RE1P
BLUE0	9				
BLUE1	11		7	1KΩ	VESA / JEIDA
BLUE2	64				
BLUE3	1				
BLUE4	48				
BLUE5	49				
BLUE6	50				
BLUE7	52				
BLUE8	53				
BLUE9	54				
Hsync	55				
Vsync	57		VCC	LCM Module	
Data Enable	58				
CLOCK	12				

Notes:
1. The LCD module uses a 100 Ohm(Ω) resistor between positive and negative lines of each receiver input.
2. Refer to LVDS transmitter data sheet for detail descriptions. (THC63LVD103 or Compatible)
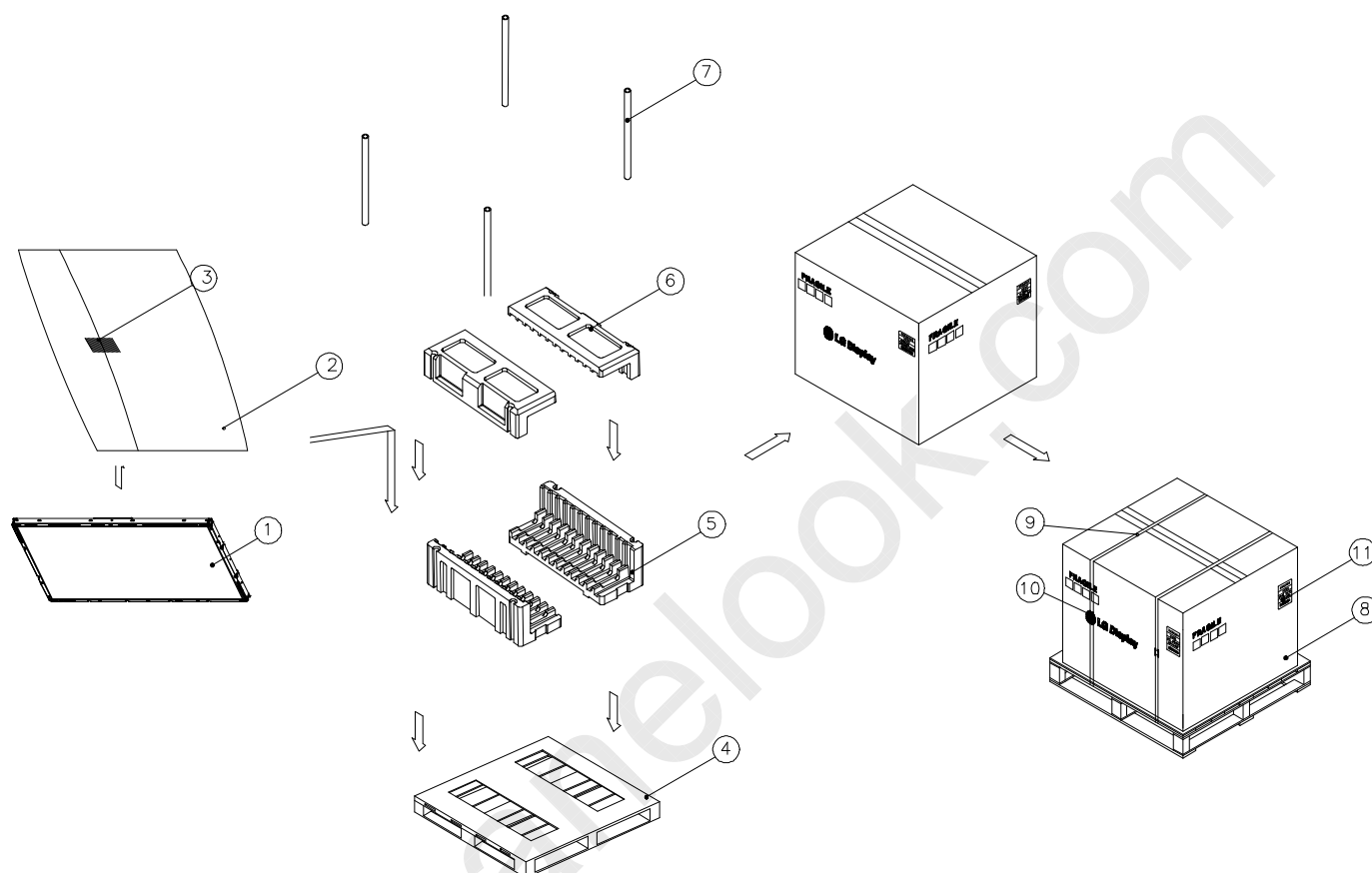3. '9' means MSB and '0' means LSB at R,G,B pixel data.

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Product Specification
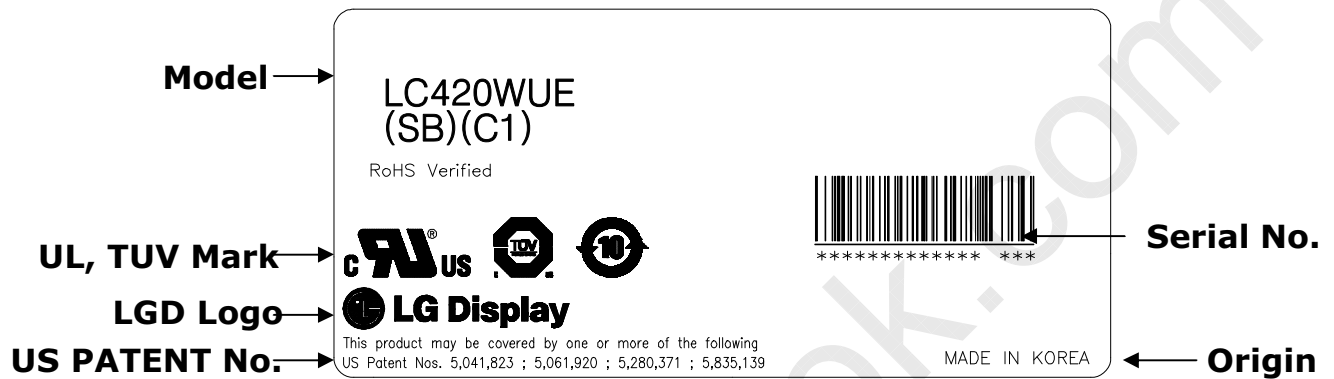
APPENDIX- II

■ Pallet Ass'y

NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	42INCH
3	TAPE	MASKING 20MM X 50M
4	PALLET	Plywood (1140X990X125.5)
5	PACKING	EPS
6	PACKING	EPS
7	ANGLE PACKING	PAPER
8	ANGLE COVER	PAPER
9	BAND,CLIP	STEEL
10	BAND	PP
11	LABEL	YUPO PAPER 80G 100X100

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APPENDIX- III
■ LCM Label

Model → LC420WUE
(SB)(C1)
RoHS Verified

UL, TUV Mark → cᴿ𝐔ᴸus TÜV 10

LGD Logo → LG Display

US PATENT No. → This product may be covered by one or more of the following
US Patent Nos. 5,041,823 ; 5,061,920 ; 5,280,371 ; 5,835,139

*********** *** ← Serial No.

MADE IN KOREA ← Origin

APPENDIX- IV
■ Pallet Label

LC420WUE		
SBC1		
13 PCS	001/01-01	
MADE IN KOREA		RoHS Verified

XXXXX XXXXXXXX XXX XXX XXXX

100.0

100.0   RoHS Verified
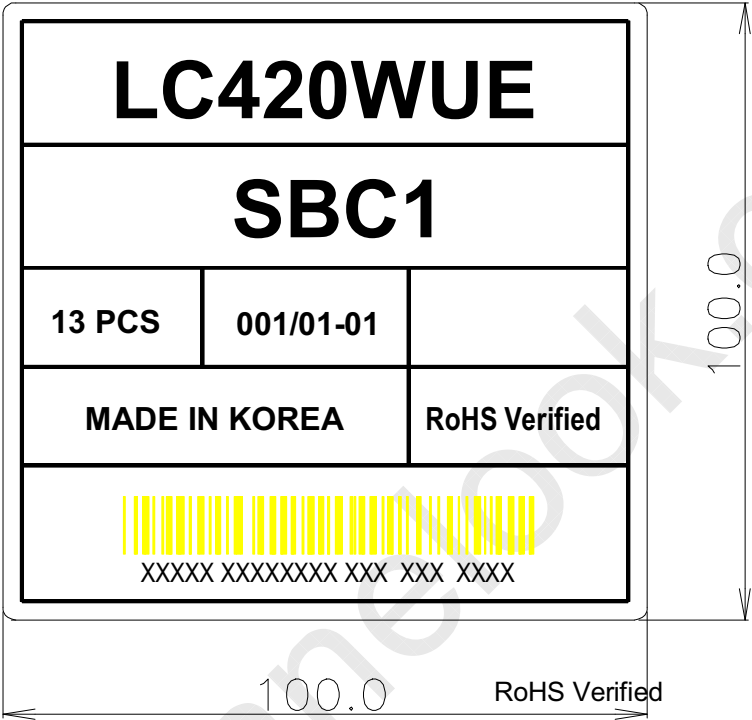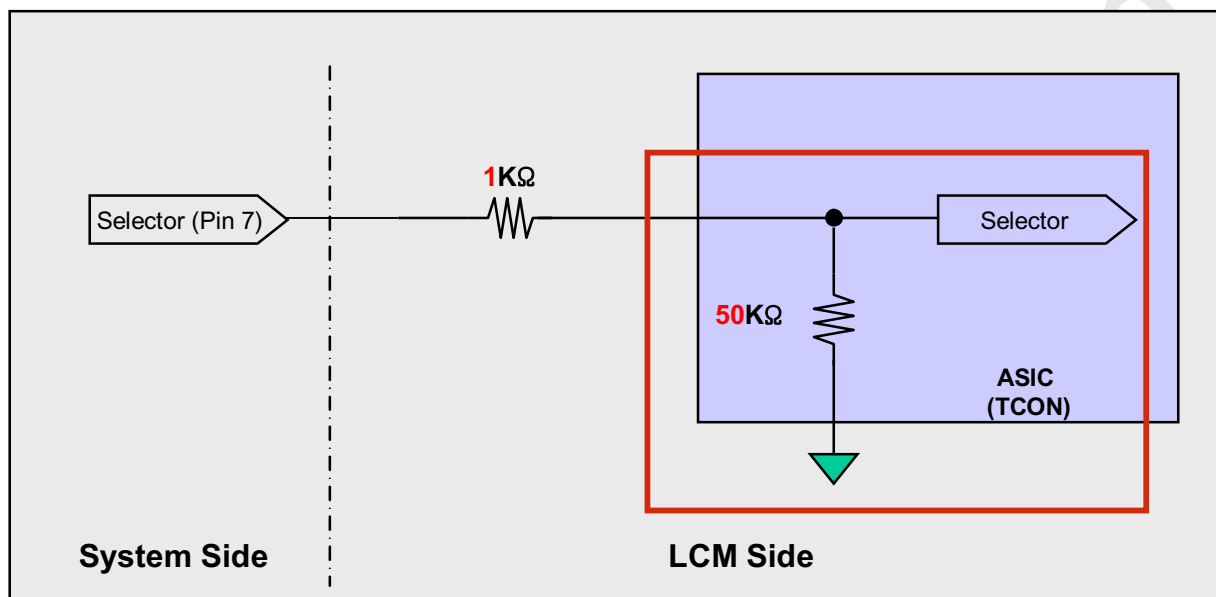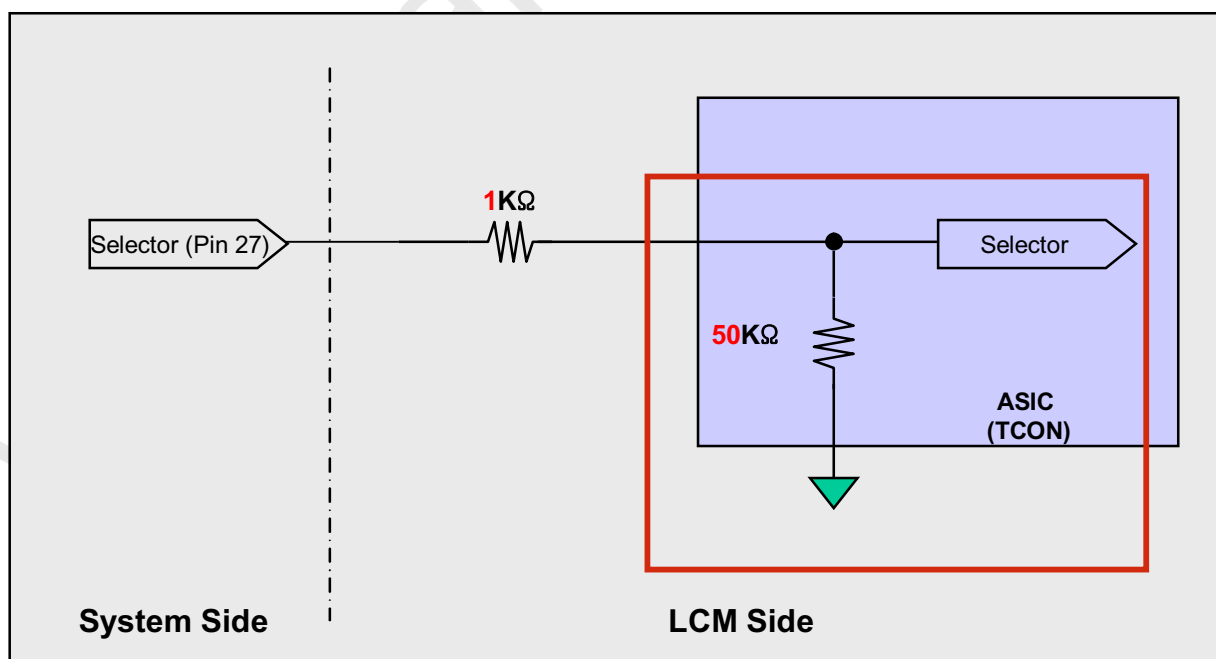
Product Specification

APPENDIX- V-1

Option Pin Circuit Block Diagram

Circuit Block Diagram of LVDS Format Selection pin
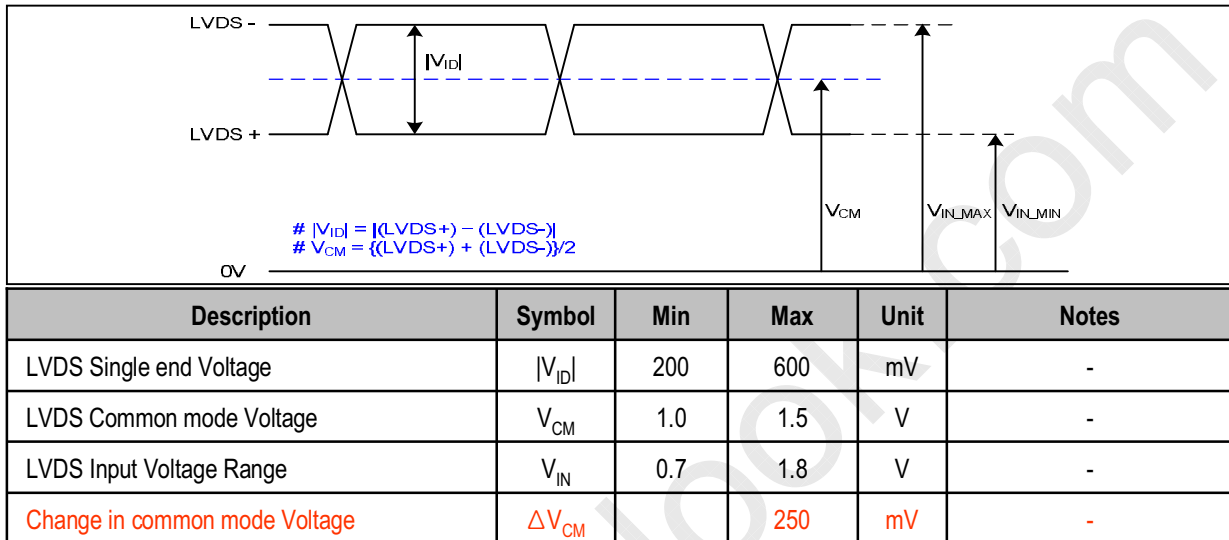

Circuit Block Diagram of Interlace Free Selection pin
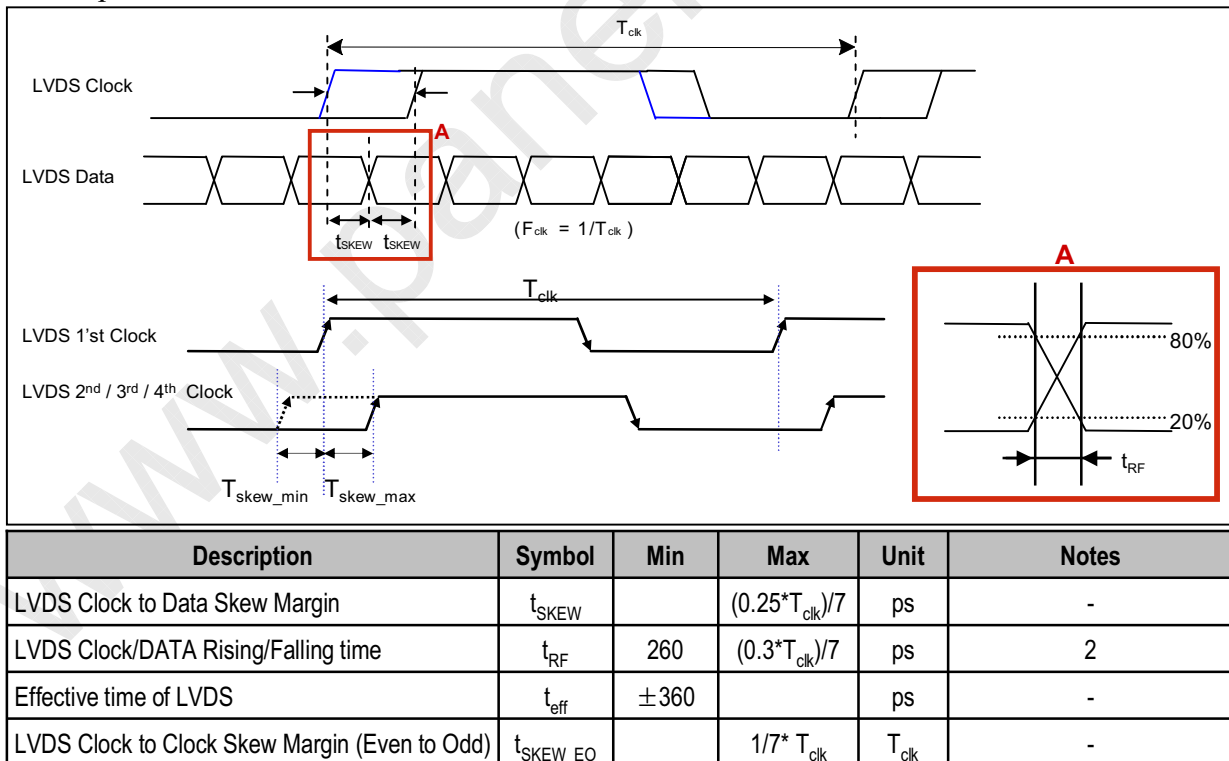
LC420WUE

Product Specification

APPENDIX- VI-1

LVDS Input characteristics

1. DC Specification

$|V_{ID}| = |(LVDS+) - (LVDS-)|$
$V_{CM} = \{(LVDS+) + (LVDS-)\}/2$

Description	Symbol	Min	Max	Unit	Notes
LVDS Single end Voltage	$|V_{ID}|$	200	600	mV	-
LVDS Common mode Voltage	V_{CM}	1.0	1.5	V	-
LVDS Input Voltage Range	V_{IN}	0.7	1.8	V	-
Change in common mode Voltage	$\triangle V_{CM}$		250	mV	-

2. AC Specification

$(F_{clk} = 1/T_{clk})$

Description	Symbol	Min	Max	Unit	Notes
LVDS Clock to Data Skew Margin	t_{SKEW}		$(0.25*T_{clk})/7$	ps	-
LVDS Clock/DATA Rising/Falling time	t_{RF}	260	$(0.3*T_{clk})/7$	ps	2
Effective time of LVDS	t_{eff}	± 360		ps	-
LVDS Clock to Clock Skew Margin (Even to Odd)	t_{SKEW_EO}		$1/7* T_{clk}$	T_{clk}	-

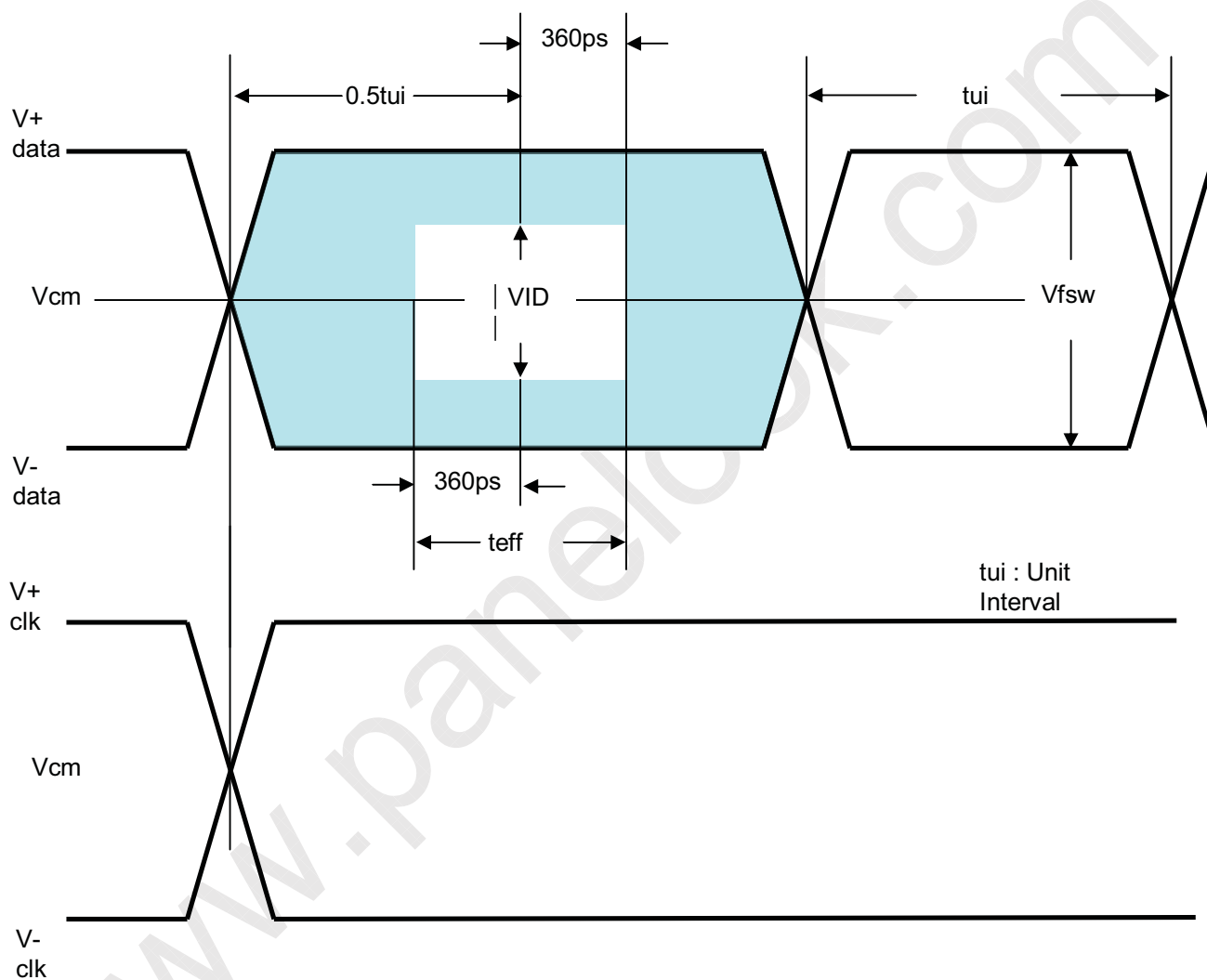Notes : 1. All Input levels of LVDS signals are based on the EIA 644 Standard.
   2. If t_{RF} isn't enough, t_{eff} should be meet the range.

Product Specification

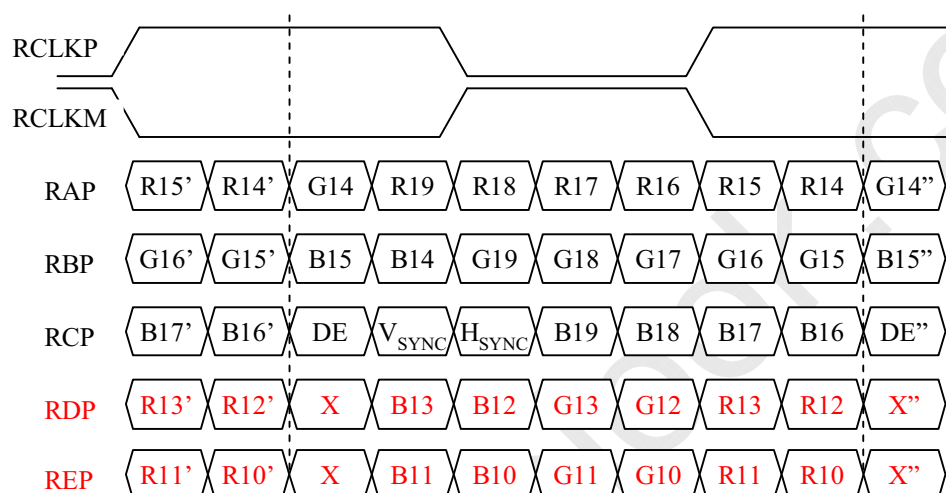# APPENDIX- VI-2

LVDS Input characteristics

360ps

0.5tui

tui

V+
data

Vcm

VID

Vfsw

V-
data

360ps

teff

tui : Unit
Interval
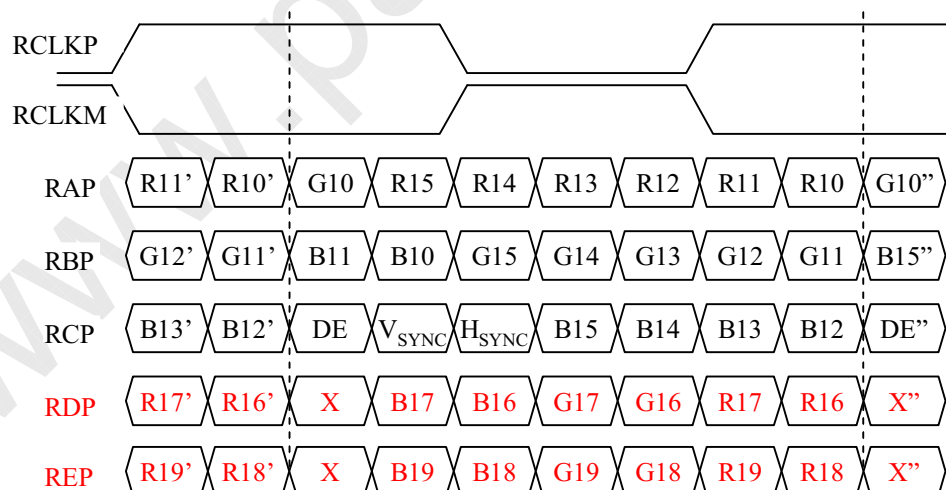
V+
clk

Vcm

V-
clk

Product Specification

APPENDIX- VII-1

LVDS Data-Mapping info. (10bit)

■ LVDS Select : "H" Data-Mapping (JEIDA format)
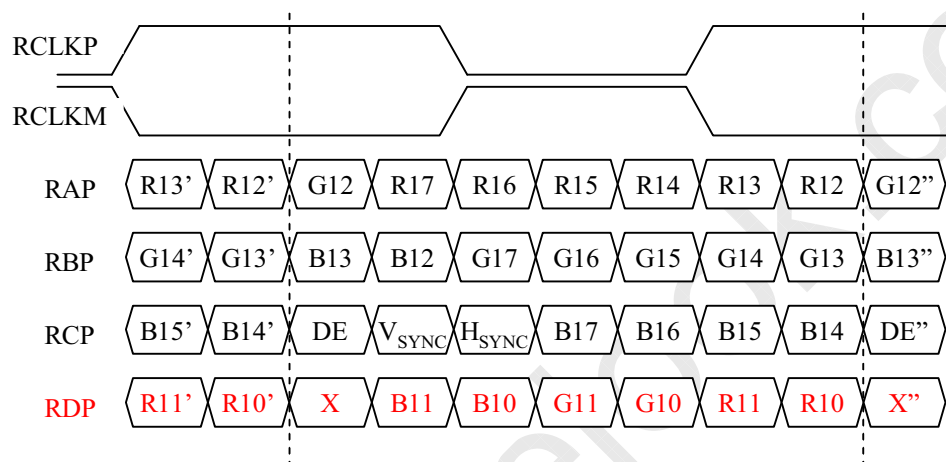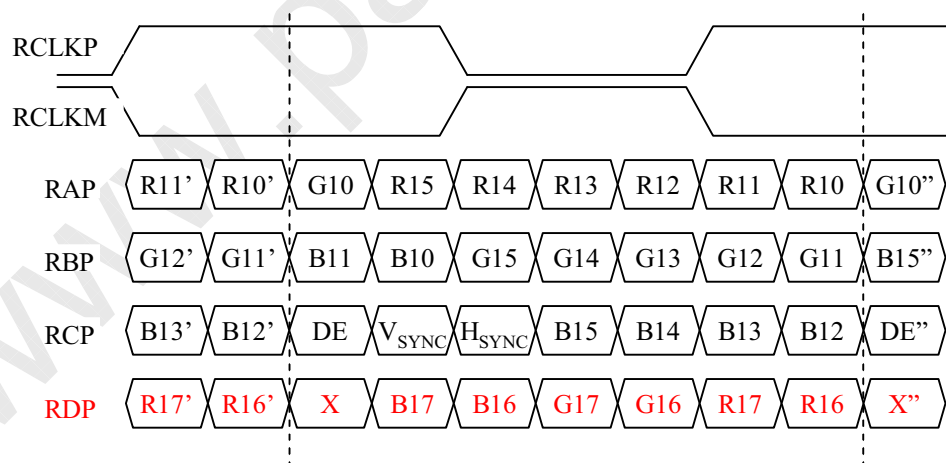

■ LVDS Select : "L" Data-Mapping (VESA format)

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Product Specification

APPENDIX- VII-2

LVDS Data-Mapping info. (8bit)

■ LVDS Select : "H" Data-Mapping (JEIDA format)

	RCLKP									
	RCLKM									
RAP	R13'	R12'	G12	R17	R16	R15	R14	R13	R12	G12"
RBP	G14'	G13'	B13	B12	G17	G16	G15	G14	G13	B13"
RCP	B15'	B14'	DE	V$_{SYNC}$	H$_{SYNC}$	B17	B16	B15	B14	DE"
RDP	R11'	R10'	X	B11	B10	G11	G10	R11	R10	X"

■ LVDS Select : "L" Data-Mapping (VESA format)

	RCLKP									
	RCLKM									
RAP	R11'	R10'	G10	R15	R14	R13	R12	R11	R10	G10"
RBP	G12'	G11'	B11	B10	G15	G14	G13	G12	G11	B15"
RCP	B13'	B12'	DE	V$_{SYNC}$	H$_{SYNC}$	B15	B14	B13	B12	DE"
RDP	R17'	R16'	X	B17	B16	G17	G16	R17	R16	X"

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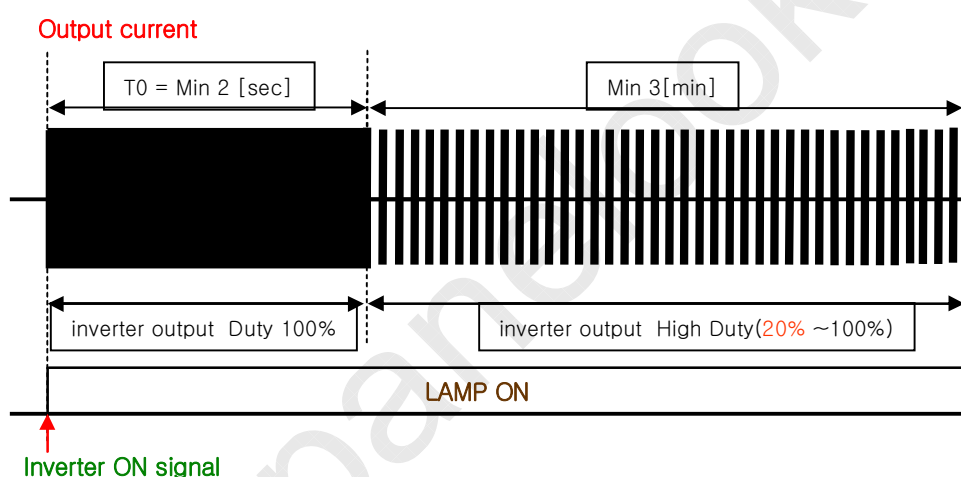| Product Specification |
|---|

APPENDIX- VIII-1

Mega DCR using condition(1)

🟢 **After Inverter ON signal, PWM Duty 100% should be sustained during 2sec.**

🟢 **It is recommended not to sustain more than 10 min for Deep Dimming**
   (Inverter output   Low Duty 0%~20%).

The deep dimming must be used very carefully due to limitation of lamp characteristics and specification.

1) For stable lamp on, its duty condition should follow below the condition.
   After Inverter ON signal, T0 duration should be sustained.

Output current

T0 = Min 2 [sec]		Min 3[min]

inverter output Duty 100%	inverter output High Duty(20% ~100%)

LAMP ON

Inverter ON signal

2) Low duty(0%~20%) of **the inverter output current**, B/L may not satisfy some of LCM specification.

 - Duration : the low duty operation(0 ~ 20%) must be limited within 10 minutes for one time operation.

 - Ratio : the period of the low duty operation must be less than 1/5 compare to that of the high duty
             operation(20~100%) in a certain period to prevent unwanted operation.

 - FOS : partial darkness or darkness of center area during the low duty might be happened due to
             insufficient lamp current.

 - Warm up : the low duty must be used 3 min after the lamps "ON". In case of low temperature, more
             warm up time may be needed.

Product Specification

APPENDIX- VIII-2

Mega DCR using condition(2)
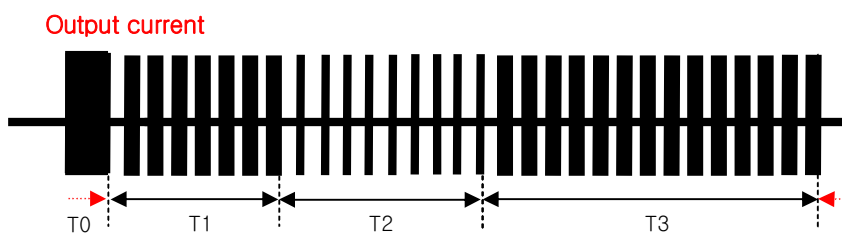
Output current

Parameter	Value			Unit	Note
	Min	Typ	Max		
T1	3	-	-	min	inverter output High Duty[20~100%]
T2	-	-	10	min	Inverter output Low Duty[0~]
T3	T2 x 5	-	-	min	inverter output High Duty[~100%]

3) The output current duty may not be same as input PWM duty due to rise/fall time of output.

4) Following the recommended conditions as aforementioned, there is no difference of lamp

lifetime between conventional method and new one.

LC420WUE

APPENDIX- IX

Gray to Gray Response Time Uniformity

This is only the reference data of G to G and uniformity for LC420WUE-SBC1 model.

1. G to G Response Time :
   Response time is defined as Figure3 and shall be measured by switching the input signal for
   "Gray (N) " and "Gray(M)".(32Gray Step at 8bit)

2. G to G Uniformity
   The variation of G to G Uniformity , δ G to G is defined as :

$$\text{G to G Uniformity} = \frac{Maximum(GtoG) - Typical(GtoG)}{Typical(GtoG)} \leq 1$$

   *Maximum (GtoG) means maximum value of measured time (N, M = 0 (Black) ~ 255(White), 32 gray step).

|	0Gray	32Gray	64Gray	…	223Gray	255Gray
0Gray		TrR:0G→32G	TrR:0G→64G	…	TrR:0G→223G	TrR:0G→255G
32Gray	TrD:32G→0G		TrR:32G→64G	…	TrR:32G→223G	TrR:32G→255G
64Gray	TrD:64G→0G	TrD:64G→32G		…	TrR:64G→223G	TrR:64G→255G
…	…	…	…		…	…
223Gray	TrD:223G→0G	TrD:223G→32G	TrD:223G→64G	…		TrR:223G→255G
255Gray	TrD:255G→0G	TrD:255G→32G	TrD:255G→64G	…	TrD:255G→223G	

3. Sampling Size : 2 pcs

4. Measurement Method : Follow the same rule as optical characteristics measurement.

5. Current Status

   Below table is actual data of production on **Sep. 11, 2008 (LGD RV Event Sample)**

	G to G Response Time [ms]		Uniformity
	Min.	Max.	
# 1	4.5	6.9	0.38
# 2	4.7	7.4	0.48

< # 1 >

< # 2 >

Ver. 1.0
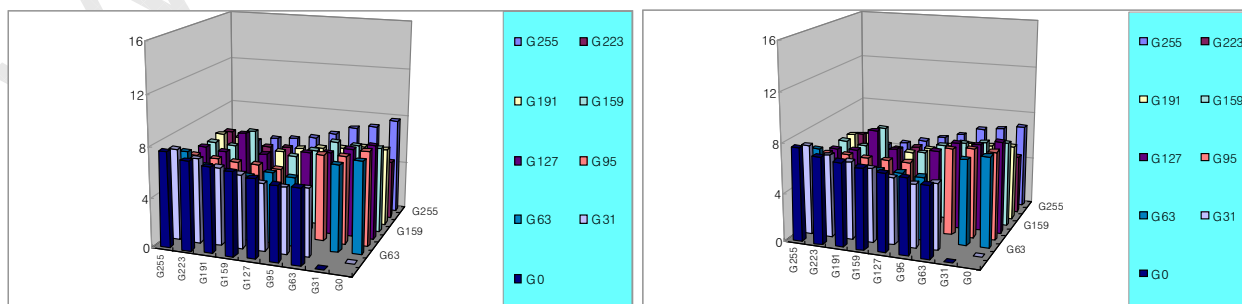
LC420WUE

Product Specification

APPENDIX-X

■ Lamp Electrical spec

	Item	Unit	Standards	
			Frequency	Characteristics
1	Lamp Voltage　∨ʟ	Vrms	45kHz	1,640±7%　IL=3.0mA (25℃) 2,030±7%　IL=7.0mA (25℃) 2,100±7%　IL=7.5mA (25℃) 2,180±7%　IL=8.0mA (25℃)
2	Lamp Current　Iʟ	mArms		Min　3.0 Typ　7.5 Max　8.0
3	Lamp power VL x IL	W	45kHz	4.4　IL=3.0mA 8.8　IL=7.0mA 9.3　IL=7.5mA 9.7　IL=8.0mA
4	Starting Voltage　∨s	Vrms	45kHz	MAX 2,450 (0℃) Typ. 2,040 (0℃) MAX 2,040 (25℃) Typ. 1,700 (25℃)
5	Average Luminance at Lamp Center　L	Cd/m²	45kHz	11,600±10%　IL=3.0mA 25,300±10%　IL=7.0mA 26,800±10%　IL=7.5 mA 28,300±10%　IL=8.0mA
			65kHz	12,100±10%　IL=3.0mA 26,300±10%　IL=7.0mA 27,800±10%　IL=7.5 mA 29,300±10%　IL=8.0mA
6	Effective Light Emitting Area LE	mm		884.0　Min
7	Color Coordinates	x		0.250±0.01
		y		0.222±0.01
8	Peak spectrum (reference)	nm		Red　　611 Green　543 Blue　　450
9	Discharge Stabilization Time	min		3
10	Operating Frequency	kHz		40~45(Typ)~80
11	Life Time	Hours		Target Min 50,000(at 8mA) Target Ave 60,000(at 8mA)

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Product Specification

APPENDIX-XII

■ Starting(Striking) Voltage mesurement method.

Measure the high voltage point of Balance Ass'y after removing all lamp.
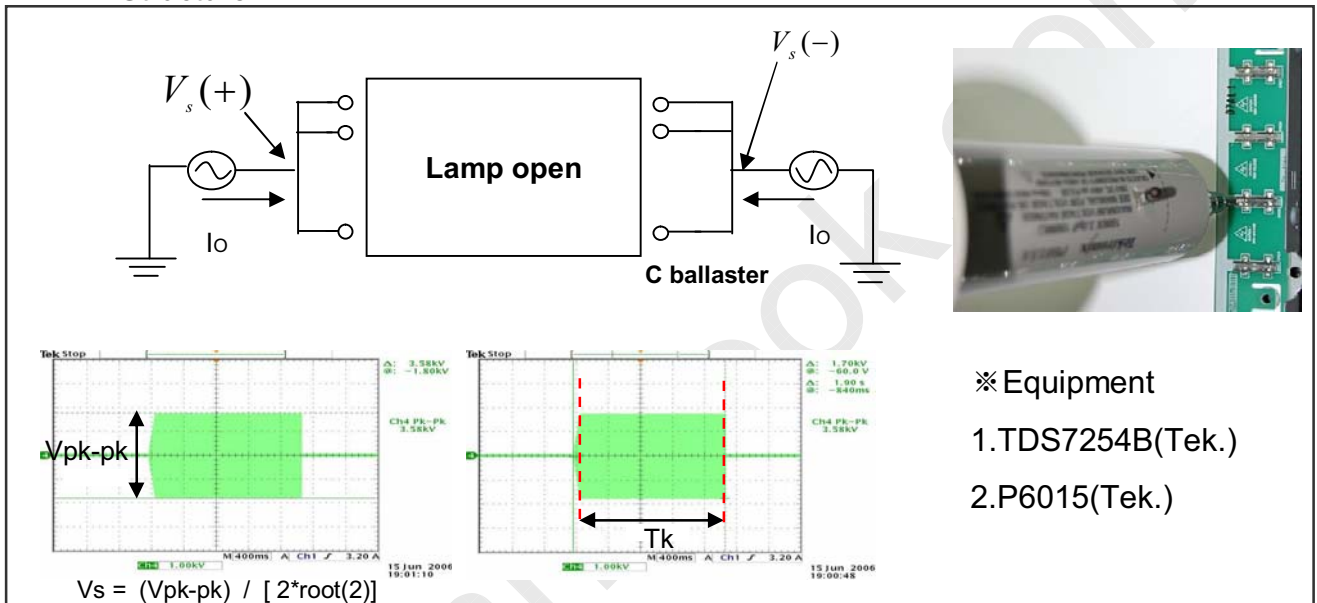
- EEFL Structure

$V_s(+)$

$V_s(-)$

Lamp open

Io

Io

C ballaster

Vpk-pk

Tk

※Equipment

1.TDS7254B(Tek.)

2.P6015(Tek.)

$Vs = (Vpk\text{-}pk) / [\ 2*root(2)]$

Figure 2 . EEFL Vopen